JACOBS ENGINEERING GROUP INC.
ENVIRONMENTAL SYSTEMS DIVISION
222 S. RIVERSIDE PLAZA - SUITE 1870 CHICAGO, ILLINOIS 60606 (312) 648-0002 FAX (312) 648-0551

January 24, 1989

Dr. Winifred Oyen
Midland Health Department
125 W. Main Street
Midland, MI 48640

Dear Dr. Oyen:

Enclosed please find the following information for the Dow Midland Superfund Site located in Midland, Michigan. This Information Repository is provided you by the U.S. EPA through this office.

Transcripts from the April 28, 1988 public meeting

This repository should be available for public review during normal business hours.

According to the Superfund Amendments and Reauthorization Act of 1986 (SARA) 9617(d)

> **"...each item developed, received, published or made available under this section shall be available for public inspection and copying at or near the facility at issue."**

Periodically, updated information will be sent to you by the U.S. EPA or this office. This information should be hole-punched and placed in the repository notebook. it is very important that all documents sent to you be placed in the repository upon receipt. Additionally, no extraneous documents (newspaper clippings, correspondence, etc.) may be kept in the repository.

If you have any questions or require additional information, please feel free to contact me at (312) 648-0002.

Sincerely,

Mary F. Blaney

Mary F. Blaney
Environmental Scientist

Enclosures

cc: J. Perrecone

JACOBS ENGINEERING GROUP INC.
ENVIRONMENTAL SYSTEMS DIVISION
222 S. RIVERSIDE PLAZA - SUITE 1870 CHICAGO, ILLINOIS 60606 (312) 648-0002 FAX (312) 648-0551

January 24, 1989

Ms. Emilia Parker
Grace A. Dow Memorial Public Library
1710 W. St. Andrews Drive
Midland, MI 48640

Dear Ms. Parker:

Enclosed please find the following information for the Dow Midland Superfund Site located in Midland, Michigan. This Information Repository is provided you by the U.S. EPA through this office.

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ENVIRONMENTAL SYSTEMS DIVISION
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January 24, 1989

Mr. Kurt Shaffner
Ingersoll Township Hall
4400 Brooks Road
Midland, MI 48640

Dear Mr. Shaffner:

Enclosed please find the following information for the Dow Midland Superfund Site located in Midland, Michigan. This Information Repository is provided you by the U.S. EPA through this office.

Transcripts from the April 28, 1988 public meeting

Risk Management Recommendations for Dioxin Contamination at Midland, Michigan Final Report

This repository should be available for public review during normal business hours.

According to the Superfund Amendments and Reauthorization Act of 1986 (SARA) 9617(d)

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Mr. John Perrecone
TES IV Primary Contact
U.S. Environmental Protection Agency
Region V
230 South Dearborn Street
Chicago, IL 60604

RE: Contract No. 68-01-7351
Project No. 05-B177-00
Work Assignment No. 177
Dow/Midland Dioxin Site
Community Relations Support
CERCLA, Region V

Dear Mr. Perrecone:

Please find herewith seven (7) copies of the Midland Risk Assessment. One copy has been sent to each of the three repositories.

If you have any questions or require more information, please feel free to call me at (312) 648-0002.

Sincerely,

for Dean Geers
Regional Manager

Enclosures

cc: E. Howard, EPA Regional Contact
M. Blaney, Work Assignment Manager

I.1

4-28-88

UNITED STATES

ENVIRONMENTAL PROTECTION AGENGY

IN the Matter of:

PUBLIC HEARING

RE: MIDLAND RISK ASSESSMENT

Transcript of the proceedings of the Public Hearing held in the above entitled matter beginning on Thursday, April 28, 1988 at or about 7:00 o'clock P.M. at Northeast Intermediate School, 1305 East Sugnet, Midland, Michigan, before Howard Zar, Project Manager, Dr. Mark McClanahan, Dr. Ian Nisbet, Mr. Gary Amendola, Dr. Donald Barnes, and Dr. J. Milton Clark.

MR. ZAR: Thank you. First of all I'd like to thank the high school and the city also for helping us set up the meeting.

This is a meeting on the dioxin risk assessment and risk management for Midland. I'd like to make a few brief remarks before introducing our speakers. Tonight we're going to discuss the risk assessment and risk management documents, also accept your comments on the documents. There are copies back there at the back of the podium or the back of the auditorium, rather, also some fact sheets which also contain some advice on how to file comments.

Just to review how we got here very briefly, in 1983 the Michigan DNR requested EPA with state assistance, Michigan do a series of studies of dioxin and other pollutants with much of the work being done at the Dow Chemical plant. There's been a number of reports published and several meetings on these studies including wastewater, fish, ground water, surface water, etcetera. These reports and findings have led to a number of control activities by -- and efforts by Dow Chemical in response to EPA and Michigan requirements.

Also we've been using these results lately to develop estimates of public health risks with the help

of a contractor, ICF Clements Associates. Two reports that resulted from this effort, first is the "Risk Assessment for Dioxin Contamination in Midland, Michigan," that will be referred to tonight as the risk assessment report. Second report is the Proposed Risk Management Actions for Dioxin Contamination in Midland, Michigan," that's a draft report, a public review draft so-called, that will be referred to as the risk management document tonight.

We want to advise you of the contents of these reports tonight, listen to what you have to say about them. There's an agenda that will tell you the procedure, that's also in the back. You're -- As indicated in the fact sheet we will be accepting comments, written comments and comments made tonight. Written comments may be submitted to us at any time up until June 3rd. After that we will revise the risk management document, we will provide it to people on our mailing list, people who comment tonight and to anybody who signs up in the back. You can see the folks in the back to sign up for copies if you'd like.

Tonight we'll proceed as follows: EPA and its consultant will brief you on the documents mentioned then we'll accept statements from other government officials. I understand the Michigan Department of

Public Health wishes to speak, also one of the councilmen from the city. Next we will accept questions and questions seeking clarification for the remarks that have been made. Only questions, however, at this stage. Then after the questions are finished we will accept formal comments. We have a stenographer here to record all the questions and statements, etcetera that have been made so we can review them carefully in preparing the final report.

I'd like to introduce briefly the panelists we have up here tonight. At my right Dr. Mark McClanahan is the toxicologist with the Emergency Response Branch of ATSDR, it's a federal agency that -- the ATSDR stands for Agency for Toxic Substances and Disease Registry, they're in Atlanta. He specializes in health assessments related to emergency response actions.

Next, second from the end on my right is Dr. Ian Nisbet, he's an independent consultant based in Massachusetts, specializing in exposure of risk assessments and toxic chemicals in the environment. He's consulted for the U.S. EPA on many occasions and is a recognized expert in the fields of dioxin, toxicology, exposure and risk. Dr. Nisbet was the senior author of the Midland risk assessment.

To my immediate right is Gary Amendola, who many

of you have seen before. He's an environmental engineer with the U.S. EPA's field office in Cleveland. He's been the project manager for our studies in Midland for the last five years or more.

On my left, immediate left, is Dr. Donald Barnes, who is chairman of U.S. EPA's Chlorinated Dioxin Work Group and he was recently appointed director of U.S. EPA's Science Advisory Board. Dr. Barnes is also one of the authors of the Midland risk assessment.

Dr. J. Milton Clark on my far left is the toxicologist with our pesticides and toxic substances branch of the U.S. EPA in Chicago. And last myself, I'm an environmental scientist with the U.S. EPA in Chicago and I am chairman of our dioxin task force in U.S. EPA office in Chicago.

We'd like to start, as I said, with a presentation of the risk assessment and management reports. I'd like to introduce Gary Amendola who will be followed by Dr. Nisbet.

MR. AMENDOLA: Thank you, Howard. For my presentation tonight or before I start my presentation tonight I'd like to give you little bit of background as to where we stand in this process that was initiated in 1983 and how it folds in with EPA and state environmental control programs.

As Howard indicated, many of the actions and studies that we conducted over the last five years were initiated in 1983 in response to a request from the State Department of Natural Resources. In addition, some of those programs and studies were conducted in furtherance of our own investigative efforts. At this time we are bringing these studies to a close. We have completed all the -- just about all the field work and the reports are out for public review and comment.

We believe that after June 3rd, the comment period closing, and our issuance of a final risk management report we will complete our special initiative of dioxin contamination in Midland. At that time all further work will be turned over to the various regulatory programs in the state and in EPA, that will include the RCRA permit, resource conservation and recovery act, the NPDES wastewater permit and various air permits and requirements. So we'll be very happy to have the program reach that stage.

The focus of all of these investigations has been dioxin or 2378-TCDD. I know that Don Barnes would prefer it if -- that we use the term 2378-TCDD, however, for purposes of this meeting tonight we will be using the term dioxin. We did, however, investigate many other toxic chemicals as well as dioxin in our

studies.

As probably most of you know in this audience 2378-TCDD or dioxin is an unwanted by-product of certain chemical reactions. It has been found at relatively high levels in certain types of waste products from pesticide production and production of other chlorinated organics, and more recently we're beginning to find sources of dioxin that had not been thought about earlier.

To give you a little bit of background about some of the significant events that occurred with respect to dioxin findings in Midland, Dow Chemical in 1978 notified the Department of Natural Resources of dioxin contamination in fish collected from the river. At that time the State Department of Public Health issued a fish consumption advisory recommending that people not eat any fish from the river.

From the period of 1978 to 1981 EPA cooperated with the Department of Natural Resources in a number of studies to try to determine the sources of dioxin to the river. We certainly suspected the Dow Chemical discharge and tried various different sampling programs to find out how much or whether it was coming out at that point. Most of those were not successful, principally because we could not at that time analyze

the dioxin directly in the water at low levels.

In 1981 we initiated a fish bio-accumulation study where fish were suspended in cages in the plume from Dow's effluent, in the river upstream and downstream, and at various control sites. Those data plus an experimental large volume wastewater sampling program we initiated did indicate that Dow's effluent was a source of dioxin in the river.

Right about the time of release of that study there was a great controversy regarding dioxin contamination across the country and as a result of the findings here and elsewhere, the State Department of Natural Resources requested our assistance in doing further investigative work near Midland.

Following that work and the determination that Dow's effluent was a source, in 1984, the Michigan Water Resources Commission along with the Michigan Department of Natural Resources issued a final order of abatement to Dow for dioxin clean-up. And that order provided some interim effluent limitations that had to be met in the effluent, it gave Dow a period of time to construct an effluent treatment system and also required Dow to investigate many other possible control mechanisms within the plant.

With respect to the Michigan dioxin studies that

resulted from the state request, we initiated a soil sampling program in 1983. Many of you may remember in April of '85 we released the results of that study and had a meeting, I believe it was right in this room as a matter of fact. And in 1985 we released the results of our drinking water studies. In 1986 the wastewater and river studies were released. In 1987 we completed a report on incinerator studies, which is being released. And in 1988, where we are today, we've released a risk assessment and our proposed risk management actions for the dioxin contamination.

With respect to our soil studies, we had two principal objectives, one is determine the levels of 2378-TCDD inside the Dow plant and in city soils and try to come to some determination as to what were possible sources. As part of that work we did a soil sampling program in Midland, in Middletown, Ohio, Henry, Illinois and four natural areas in Minnesota. The purpose of selecting sites outside of Midland was to find other industrialized and urban environments that are similar but had different characteristics than Midland, and also to find some background or natural areas for comparative purposes.

The data from the soil study are summarized here. Basically we did not find detectable quantities of

dioxin in any of the Minnesota natural areas. In Henry, Illinois, in Middletown, Ohio only trace quantities were found, barely above detectable levels in only a few of the samples. In Midland, however, we did find dioxin in soils from almost every -- just about every soil sample tested. However, the levels we found in Midland generally averaged well less than a tenth of a part per billion. As characterized by this graph the levels are well below the one part per billion level that CDC has established as a level of concern for dioxin in residential soils. Dioxin levels at the edge of the Dow plant and inside the Dow plant were significantly higher. Since that time, of course, there have been many remedial actions taken to either cover or cap the highest concentration areas inside the Dow plant.

We also compared in 1985 the contamination found inside of the Dow plant and in the City of Midland with some of the other what are known as tier one and two sites from EPA's national dioxin study. And generally the levels inside the Dow plant were in the lower range of what was found at other tier one and two sites and levels outside the plant fortunately were also lower than some found elsewhere.

Our conclusions were that the highest levels of

2378-TCDD were, of course, found within the Dow plant. The contamination in Midland averaged less than a tenth of a part per billion. And we suspected based upon the distribution of the dioxins in the soils and also with the evaluation of a considerable amount of work that Dow had completed at the same time that the air emissions were the likely source of dioxin outside the plant. It appeared from the nature of the distribution of the contamination inside the plant that some of it was due to fallout from air emission and some possibly due to process spills or other types of events of that nature.

We also conducted some drinking water studies. There was a concern that dioxin might be present in public drinking water supplies. We evaluated several -- Well, we evaluated three major public water supplies in Saginaw Bay, as well as several private and semi-public potable ground water wells in the area. We also wanted to determine, in addition to the dioxin, whether any other organic chemicals or other toxicants were present at levels that exceeded any drinking water criteria or standards.

This map sort of shows the location of the public drinking water supplies in Saginaw Bay. We took samples from the Saginaw-Midland intake, the Pinconning

intake and the Bay City intake. All of those samples turned out to be not detected at the lowest levels that could be achieved at that time. We also did not find dioxin in the private drinking water wells. There was an issue we had at the time of one of our contract laboratories had some contamination that required us to resample and go through some rather elaborate comparative testing to satisfy ourselves with the fact that we did not have dioxin in those wells, and that was our conclusion. We also did not find toxic organics present at levels that would exceed any of the drinking water criteria or recommended maximum contaminant levels established by EPA.

Also, as part of this work we did measure emissions from Dow Chemical's hazardous waste incinerator, and we wanted to compare the results of those emission tests with other incineration sources through the country. We did as part of that work some limited ambient air monitoring outside the Dow plant as well. Those samples were taken near the fence line of the plant and also out into the community.

This graph presents a comparison of Dow Chemical hazardous waste emissions as characterized by different air emission tests. The 1983 graph is a test that Dow had run. We had run the one in 1984, EPA did, and Dow

had run another one in 1987. So you can see that there's been a significant reduction in emissions as characterized by these tests.

The units presented there are dioxin equivalents. Dr. Nisbet later in his talk will describe EPA's toxic equivalents factors approach for the different families of dioxins. And we converted these incinerator emissions into grams per year here for comparative purposes.

Now, we also have data from our national dioxin study and we looked at various types of combustion sources there as part of the tier four or combustion source effort. And as you can see the Dow Chemical results in 1983, '84 and '87 are highlighted. And the emissions as characterized by the latest tests are certainly well within the lower range of emissions from all different types of sources. We have municipal waste combusters, sewage sludge incinerators, other hazardous waste incinerators and kraft recovery boilers. There are also many other sources tested as part of a national dioxin study that had emission rates much lower than the lowest value showed here. Our conclusions were fairly obvious, that the emissions have decreased significantly since 1983.

We also found dioxin present in the ambient air

outside the plant. We tried to make some computer modeling estimates of what the ambient concentrations would be in the air outside of the plant based upon the incinerator emissions, in other words, how much was coming out of the stack. And we found from those calculations that we could not account for the amount of material outside of the plant measured in the air with what was coming out of the stack. That plus the data that we accumulated as part of our soil study led us to believe -- leads us to believe that the amount of dioxin in the incinerator currently is much less than had been emitted in the past. Also, that there may have been other sources contributing to levels in the ambient air. These might include past process emissions and wind blown dust from the plant site.

We also did some wastewater and continued fish monitoring in the river. I might indicate that in the fish monitoring there have been a series of native fish studies in the Tittabawassee River from 1978 through as late as 1987. And those studies were done to track the levels in the fish. We also as part of Dow Chemical's NPDES permit, the company is required to monitor 2378-TCDD in its effluent twice per month. So we've been tracking those levels as well.

As you can see here this is a graph representing

the mass amount of 2378-TCDD from Dow's effluent going into the Tittabawassee River. There are two principal points I'd like to note here. First, the level of discharge has dropped significantly in November of 1985 and that was the time when Dow began operation of the mixed media effluent filter that was required by the Department of Natural Resources. And secondly there was another significant reduction beginning about July of last year when Dow began operating further controls for incinerator scrubber waters. But overall the trend here is very clear in that we have a situation where the dioxin levels going into the river have been reduced significantly.

Presented here is a graph showing the amounts of 2378-TCDD detected in game fish in the Tittabawassee River. Please note that in 1983 we have data for six fish, in 1985 it was a much larger study, we have data for 32 fish, in 1987 we have data for three fish. What I'd like to point out here that is significant is the average in '83 and '85 are very close together. And the types of fish analyzed here are principally Walleye. However, in 1985 it included Northern Pike, White Bass, small mouth Bass and a few other fish of that nature. In 1987 the limited data we had shows that the level of fish appears to be coming down. And

this is consistent with the reduction in discharge in Dow's effluent.

We also have monitored Catfish and Carp in the Tittabawassee River. And the bottom feeding fish tend to collect or accumulate much higher levels of dioxin. In 1983 in a cooperative program with the Department of National Resources we analyzed 1 Catfish and 25 Carp and had values ranging from about 10 parts per trillion up to 530 with an average of about 50.

In 1985 we had three samples and these were analyzed by Dow and I think the average there was 32. So, there is some decrease noted, although the number of fish are not significant in 1985 to draw a conclusion. In 1987 again we have three fish with the average dropping to six. The decrease in these fish, it seems to be tracking back for the game fish indicating that most probably the reduced discharge levels from Dow are having a marked impact on the fishery.

Our conclusions there are the average levels of 1983 and 1985 are about the same, particularly for the game fish. The average levels in '87 appear to be decreasing, but we only have limited data to make that conclusion. And we're saying more studies are needed in 1988 to confirm these more recent results. I might

point out we have collaborated with the Department of Health in Michigan and Department of Natural Resources on expanded fish monitoring program for 1988. In fact, the fish have already been collected and are at the analytical laboratories. Those fish will be analyzed -- most of them will be analyzed by the Department of Public Health for PCBs and other pesticides. Dow Chemical will be doing analyses of 2378-TCDD and U.S. EPA's research laboratory in Duluth, Minnesota will be doing some analysis of 2378-TCDD and for some of the other dioxins and furans that are present in fish.

With that I'd like to turn the program over to Dr. Ian Nisbet who will describe EPA's risk assessment approach and discuss our risk assessment results for Midland.

DR. NISBET: Risk assessment for a situation like this is a very complicated undertaking. A risk assessment document which is now being issued by EPA covers more 250 pages with more than 50 pages of tables. The summary which is made available by EPA, I believe copies are in this room, covers eight pages. I'm going to try to give you a little more information than is in the summary. I'm necessarily going to have to simplify the full risk assessment, but I will try to be as concise as I can.

What we try to do with this undertaking is to estimate risk. Risk is the probability that someone is going to be injured by a situation, in this case exposure to dioxin in the environment of Midland. We're not trying to measure injury. We're not trying to go out and see who has been injured by exposure to dioxin in the past. We are prospective, we try to estimate the likelihood that people will be injured as a result of present or future exposure. And when we estimate that likelihood and determine the circumstances which might lead to risk we want to do something about it. This is an example of preventive public health and it's difficult.

Risk assessment follows four standard components. First, hazard identification. What does the chemical, in this case dioxin, do? What kind of toxic effects does it cause? Second, dose response evaluation. How much do we have to be exposed to before we are likely to be injured? Third, exposure evaluation. How much are people exposed to? And finally, risk characterization. Given the hazards, the dose response information and the exposure evaluation what is the likelihood that some people will be injured and how many people? And then what can be done about it.

Let me go through these step by step. In hazard

identification we first of all review and analyze toxicity data. Ideally we would like to study what dioxin does in humans. Unfortunately, for various reasons the direct information we have about what dioxin does to people who are exposed to it is inconclusive in various ways. The principal problem is that although we have some information on people's responses, physiological responses to exposure, we have very little information about the actual magnitude of that exposure. We have exactly zero dose response information for people. Therefore, for risk assessment we necessarily rely on animal data, controlled experiments in which animals are exposed to dioxin in laboratory.

Analyzing that evidence, which is being done extensively by EPA, we weigh the evidence that the substance, in this case dioxin, causes the various toxic effects. That evidence is summarized in Chapter 2 of the risk assessment document. We then evaluate whether the toxic effects which occur in one setting will occur in other settings. And specifically what that means is that we evaluate whether the toxic effects that we observe in animals in the lab are likely to occur in humans exposed usually at lower levels. There are standard procedures for doing this

and we have followed those procedures in Chapter 2 of the risk assessment document.

EPA has identified three particular kinds of toxic effects as being most critical for risk assessment. By critical we mean these are the effects which occur at lowest doses in animals under experimental conditions and hence are the events most likely to occur in humans also exposed at low levels.

The first one of these is the increase in the risk of cancer. Dioxin increases the risk of cancer in animals exposed to it for long periods under laboratory conditions. There are some indications that it may do so in humans also. There are several suggestive studies but none of them is conclusive. EPA has a standard procedure for classifying carcinogens according to the weight of evidence. Dioxin on this categorization falls into Group B, it's referred to by EPA as a probable human carcinogen, and the basis of that is that it does increase the frequency of cancer in animals and may do so in humans, although there is no direct conclusive evidence whether it does or does not.

The next stage in evaluating the potential for dioxin to cause cancer is to look at the dose response data. For carcinogens we believe there is likely to be

no threshold dose for which there is no effect; that is, any dose is likely to give rise to some effect and at low doses the risk is approximately proportional to the dose. The relationship between risk and dose is known as the potency factor and it's so identified on this slide in terms of a risk per unit of dose. The unit of dose is expressed in picograms. A picogram is one trillionth of a gram. And that is related to the body weight of the person ingesting it in kilograms. And the dose is expressed in picograms per kilogram of body weight per day. Most people weigh between 50 and 100 kilograms, therefore, a dose of one picogram per kilogram per day is between 50 and 100 picograms per day.

According to the risk assessment procedure, if a person were to absorb that quantity of dioxin everyday throughout life his risk of -- his or her risk of getting cancer might be on the range of 1.6 times 10 to the minus 4, that is about 1 in 6,000. That is the basis for all subsequent cancer risk assessments in the risk assessment document.

In addition to cancer there are two other critical effects, critical toxic effects of dioxin, which have been observed in animals. One is an effect on reproduction. Dioxin interferes with reproduction and

causes birth defects in various species of animals and the dose responsive relationships for those effects are well documented.

At similar low dose levels it also causes toxic effects on the liver. Based on those studies EPA has derived a series of bench mark values. These are dose levels at which it can be estimated that people can be exposed for short or long periods without substantial risk of adverse effects. We end up calling them safe levels because we're never quite sure if something is absolutely safe, but we believe that these dose levels can be absorbed into the body for short or long periods with an ample margin of safety.

For long term exposures these bench mark is known as the reference dose or RFD, and based on the animal studies we estimate the appropriate dose for the RFD is about one picogram per kilogram per day. That's the long term exposure for months, years or lifetime. For shorter periods of exposure the bench mark dose is known as a health advisory, and for single dose exposures, that is a dose you might get on one day from eating a highly contaminated fish, the estimated dose for the health advisory is 300 picograms per kilogram per day or for intermediate exposures on the order of a week or two it's about 28 picograms per kilogram per

day. These are the bench mark doses that are used for all risk assessment.

So much for Chapter 2 of the risk assessment report. We now move to the exposure assessment, which is covered in Chapter 3. We're concerned with three primary routes of exposure, inhalation of vapors or airborne particulates contaminated with dioxin, ingestion, specifically ingestion of fish or inadvertent ingestion of soil, particularly by children, and contact with the skin. It turns out that skin contact is not a significant route of exposure in this context mostly because the potential for absorption through the skin is quite low for this chemical.

Exposure assessment is a very complicated procedure and raises many issues. Chapter 3 of the risk assessment report extends over 100 pages because there are so many different factors that need to be considered and discussed. Specifically we are trying to estimate the extent and the frequency of human exposure by each one of the three routes of exposure. We want to estimate how much people are exposed to, how often, over how long a period. We want to estimate the number of people exposed and we want to estimate how certain are our estimates and how variable the exposure

is.

In this case, as in nearly all cases of human exposure to environment chemicals, the exposure is very variable. Some people are much more highly exposed than others depending on their habits, where they live and what they do. So we want to characterize that range of variability in human exposure and we do it not by trying to estimate the exposure of everyone, but of trying to estimate the exposure of a typical individual or perhaps an average, if we could do that, and we also want to characterize the people who are most likely exposed in order to indicate who is most at risk and where remedial measures should be focused. We don't try to get the extreme high, we don't try to estimate the individual who had the greatest exposure, we try to estimate someone with -- near the upper end of the range to characterize a substantial number of people who are at highest risk.

In Chapter 3 we considered a series of exposures in our areas, we considered exposure of our air, inhalation of contaminated air, we considered exposure via soil, primarily ingestion of contaminated soil, and we've considered ingestion of contaminated fish from the Tittabawassee River. In each case we've considered two exposure scenarios, a higher exposure which

characterizes the upper end of the exposure distribution, and a lower exposure which characterizes somewhere in the middle. We didn't have enough information to be confident in saying we calculated the average exposure or the immediate exposure but we believe that these numbers are somewhere in the middle of the range of likely exposures at Midland.

In the case of air we considered two locations of residents, the lower exposure is for a person living in the middle of a residential area of Midland, about a mile away from the plant, the higher exposure is a hypothetical person living very close to the fence line of the Dow facility on the downwind side. And each of these were characterized in 1984 by actual sampling of the ambient air.

For the soil the main reason for the difference between higher and lower exposure is the behavior of the individuals. The main source of exposure is by children who play on the ground and get soil on their hands and then put their hands in their mouths, that kind of exposure has been reasonably well characterized now and is known to be variable. We took numbers from the literature including a review that we had done ourselves. The lower exposure was somewhere in the middle of the range of recorded values, the higher

exposure was near the upper end of the recorded values. And we also considered an extreme case, a child with what is known as pica. Pica is an unusual disorder in which children have an unusual craving to put objects in their mouths and swallow them. This applies not only to soil but also things like leaded paint.

For the fish consumptions we considered only people who eat fish from the Tittabawassee River. That it serves as a limited population, certainly some hundreds of people and probably some thousands of people. Within that group we considered a variety of fish consumption patterns based on documentation of how much fish people eat in other areas. They range from what we call the occasional consumer, who might eat fish from the Tittabawassee River about once a month, up to higher consumers at the upper end of the range, we considered it possible that some people might eat fish from the Tittabawassee River as much as three times a week, the maximum consumer being someone who would eat not only game fish but also bottom fish such as Catfish, which are known to be more highly contaminated. There is a wide range of possible intakes but they're all from within a limited population.

Within all of those scenarios, particularly the

higher exposure scenarios, we followed a standard procedure of using what we call conservative exposure assumptions. We don't know exactly how much fish people eat or how much air they breath or how much soil they eat. We took values from the literature, but in doing so, to avoid underestimating risk we tended to take the higher values. In particular, we used all environmental data from 1983 to 1987. We averaged all the fish data between 1983 and 1987, even though, as you've just seen, there's some limited evidence that the levels in fish have fallen substantially in 1987. We don't know that for certain yet. We used soil data from a 1983 survey and we used air data from a 1984 survey. It is quite possible that levels of exposure have begun to go down. We don't know that yet, but we have structured the risk assessment so that if the 1988 surveys indicate that the levels have continued to go down then all the exposure and risk calculations can be redone.

We also calculated exposure specifically for people who are long term residents of Midland. For the cancer risk assessments we essentially considered people who are -- who will be lifetime residents of Midland. For the air exposure we considered people who were breathing the air at the specified location for 24

hours a day but not people who commuted outside. And in the case of the higher exposure scenarios we took all of the high intake rates deliberately to characterize the upper end of the exposure distribution. So in evaluating the risks you should be aware that we are considering the long term residents, we're considering current levels assuming that they will not go down and in the higher exposure scenarios we are deliberately looking at the upper end in order to characterize those highly exposed people.

Everything I've said up to now has been concerned with 2378-TCDD. In addition to 2378-TCDD there are a number of other dioxins and furans which have been detected in the Midland environment. 2378-TCDD is the -- probably the most toxic and the most characteristic of this -- these two families of chemicals which contain altogether 210 chemicals.

In order to characterize risks posed by exposure to complex mixtures, EPA has done an approach known as the toxicity equivalency factor approach. This is based on the scientific knowledge that most compounds in these two families act in the same way as 2378-TCDD only they are less potent. By less potent I mean that larger quantities of these other compounds are required to cause the same effects as the quantities of

2378-TCDD. So to estimate the toxicity of these individual compounds we estimated exposure to and multiplied them by a relative potency factor in order to come up to an equivalent form of the dioxin, 2378-TCDD. We then add up the effect of all the compounds and estimate the total amount of dioxin equivalents to which people are exposed. This procedure has now become standardized, it's reasonably well accepted in the scientific community and we have used it uniformly throughout this risk assessment where we have such data.

At Midland we found that 2378-TCDD was by far the most important single compound of these 210. In soil this one single compound contributed about 90 percent of the total toxic equivalents. In fish, however, it only contributed about 40 percent. That is, we estimate the total risks posed by the mixture to be about two and a half times those posed by 2378-TCDD itself. So it's important to consider those in fish but they are not overwhelmingly important. And as I say, 2378-TCDD is the most important single compound.

We've now covered the -- the first three components of risk assessment, hazard identification, the three critical toxic effects, dose response assessment, we identified three bench marks, exposure

assessment, we have exposure assessed for about twelve different exposure scenarios, and now we put these two together to estimate -- characterize the risks that would arise under each of the scenarios.

This slide characterizes our estimates, which are presented in Chapter 4 of the risk assessment document of the cancer risks which might result from exposure to dioxin due to the entire mixtures in Midland as a result of the exposure scenarios and under the rather conservative assumption which I've described. And it goes -- of uncertainties in both the exposure and the dose response evidence we have characterized these only to the nearest power of ten.

Working from the bottom of this table, from the bottom right, exposure via air and soil under the lower estimates, that's the somewhere in the middle of the range of exposure is likely to give rise to cancer risks, in the ballpark of one in a hundred thousand or one in a million. Those are not high numbers, those are ranges of cancer risks at which EPA usually begins to consider remedial actions. In soil and air the only exposure scenarios which lead to estimated risks greater than one in a hundred thousand are these two which are the extreme exposure assumptions, a person living close to the Dow fence line throughout life and

exposed 24 hours a day to current levels of airborne contamination or a child with pica who lives in the residential area of Midland throughout his childhood years. Each of these scenarios is pretty unlikely. They are extreme, they can't be ruled out, but generally we feel that for air and soil numbers in this ballpark are characteristic and those are the numbers of our risk assessment.

On the other hand, risks resulting from consumption of fish are much higher. Our occasional consumer was a person who eats a modest size fish meal, about a fourth a pound of fish from the Tittabawassee River about once a month. According to the assumptions we have made which assume that present levels of dioxin would be maintained for long periods into the future that person might suffer an excess cancer risk as high as one in ten thousand. Individuals with higher exposure could suffer much higher cancer risks. This high sports fisherman is a person that eats a larger meal, say half a pound three times a week over a long period, that person's risk might be as high as one in a thousand. The maximum consumer is a person with similar consumption but someone who eats the more contaminated bottom fish, that person's risk could be in the ballpark of 1 percent. Those are high risks and

those completely dominate the cancer risks posed by exposure to dioxin among all the routes that we considered.

I'm not presenting slides for the non-cancer risks, the risks of reproductive effects, of birth defects and of liver toxicity, those are in the risk assessment document in Chapter 4. They essentially fall into the same pattern as these. For air and soil in almost all cases the estimated exposures are below the bench mark levels at which we estimate that the likelihood of adverse effects is very low. It's only for the child with pica and individuals living near the fence line who would be at substantial risk of any adverse non-cancer effects.

On the other hand, considering the fish exposures, these same individuals will also be at risk of non-cancer effects; that is, a pregnant woman eating fish even at this low rate would be taking in dioxin, dioxin equivalents at a rate greater than the RFD and, hence, would not have an adequate margin of safety. And individuals with a higher exposure would be at correspondingly higher risk.

So that is the output of our risk assessment exposure via air and soil is at -- risks resulting from exposure via air and soil are at worst marginal. Under

extreme exposure conditions there may be some risk, although these extreme exposure conditions are quite unlikely. Exposure via fish make -- under the exposure assumption, more conservative exposure assumption we discussed in the report may lead to substantial risks both of cancer and of non-cancer adverse effects.

That is the outcome of the risk assessment portion of our study. The risk characterization of that leads right on into the risk management area. I turn this back to Gary Amendola.

MR. AMENDOLA: Thank you, Dr. Nisbet. As you can see from the intertwined circles here the risk assessment and risk management flow into one another. The risk characterization leads to some sort of a regulatory decision, and as part of that there is consideration of much more than the risk assessment results. In many cases there are various control options that are considered as well as non-risk analyses. They might be things such as statutory requirements that would mandate a control option, whether or not the control option resulted in a significant risk reduction or they might be public concerns or information about cost and economic benefits.

Some of you may be wondering why we're having this

meeting here today in 1988 when a lot of this work was done in 1985. I think that's a very legitmate question. One of the reasons is this is, as Dr. Nisbet pointed out, a very complex task. And while this was going on there have been a lot of activities to minimize exposures and minimize emissions from Dow Chemical. The State of Michigan, for example, in 1984 issued its dioxin order we discussed earlier. In 1985 when we found high contamination -- high dioxin contamination on the site, a CERCLA or Superfund abatement order was issued to Dow for clean up of those sites. More recently in 1986 the state implemented a death suppression program with Dow. And we have ongoing record of RCRA permitting and NPDES wastewater permitting activities going on at the same time.

Also, I'd like to point out that there have been a number of actions that Dow has undertaken unilaterally to minimize some of these emissions and discharges that we've just spoken about. In the late 1970s most chlorinated phenols -- production of most chlorinated phenols was terminated at the plant site. Dow has installed a riverbank preventive system to collect contaminated ground waters at the site for treatment, and they have also approved their incinerator operations and otherwise complied with the permits and

orders issued by EPA.

So essentially upon evaluating the progress that's been made, the results that we're beginning to see in downward trends in environmental levels, when we got to risk management, you know, the obvious focus, of course, is looking at the sources, we found and concluded that many or most of the control options that need to be considered have either been installed or are being implemented. We were not faced with evaluating twelve different kinds of treatment for dioxin from Dow's incinerator or the wastewater discharge. Fortunately, we're in the situation of basically trying to monitor where we stand now and looking for further improvements where possible.

Accordingly we've developed risk management actions for Dow that focus on the wastewater and air. On wastewater as part of the next NPDES permit for Dow we've advised the state and have agreed with the state that conditions should be put in Dow's permit that should focus on research to determine whether any additional treatment of the Dow effluent is feasible. Second, we've asked for some studies as to the effectiveness of the incinerator treatment system and also on whether any sediments in Dow's tertiary pond would pass through the effluent filter and may be

contributing to the effluent discharge.

On air, Dow has been implementing a program of improving its incinerator combustion conditions and operating controls and we recommend that program continue. Also, we recommend that Dow continue to implement the dust suppression program to minimize wind blown dust from the plant site. That program, again, is a requirement of the MDNR.

Also, in our proposed risk management actions we've outlined a number of monitoring programs that we think might be appropriate. And again, these are all things and points that we are seeking public comment on. We believe it's appropriate that Dow Chemical continue to monitor the wastewater discharge in accordance with its permit condition so we can track the levels. Some of you may be aware that the Department of Natural Resources has indicated that the desired level of dioxin discharged in Dow's effluent should be about .1, 0.1 parts per quadrillion, which is less than the current discharge rate of 1 to 2 parts per quadrillion, and also much less than the current discharge limit of 10 parts per quadrillion.

We recommend that there be some supplemental incinerator emission and ambient air testing as part of Dow's RCRA permit requirements, that Dow will have to

conduct additional incinerator trial burns to determine the destruction of efficiency of the incinerator. We recommend that some additional samples be collected at that time for specific purposes. Also, we're interested in having some ambient air testing done again to determine the effectiveness of some of these programs. We have one set of data collected in 1984 which was before any of the dust suppression programs or CERCLA remedial actions at the site were implemented.

Finally, we think that there should be continued Tittabawassee River fish monitoring. We're not finally but third. We have, in fact, as I indicated earlier, collaborated with the state and Dow on a program for 1988 to better characterize the levels in the fish. We also believe that it might be a good idea to check the river sediments, there's been a big flood here a couple years ago which probably moved and disturbed some sediments and we think there should be a program to evaluate sediment quality. And finally we think it might be appropriate to look at some limited food chain studies. For example, some of the aquatic life and birds and animals that live near the river. Also, to characterize some possible other human routes of exposure or possible routes of exposure, some limited

dairy sampling might be appropriate.

Okay. As part of our effort, as Dr. Nisbet pointed out, we characterized the risk of consuming Tittabawassee River fish as presenting the highest exposure and also the highest risk to people who eat those fish. Currently the MDPH or when the slide was presented, in any event, the MDPH had an advisory against eating Catfish and Carp. More recently they've amended that to include game fish restrictions for women of child bearing age, and I'm sure the Department of Health will discuss that in detail later. We recommend that people heed those advisories. Also, if people are going to eat fish from the Tittabawassee River, the state guidelines for cleaning the fish should be followed. Those guidelines were designed with the idea of trimming away those portions of the fish that contain the most contaminants. And the risk assessment document as well as the State Michigan Fishing Guide describes in detail those procedures.

Finally, we felt it might be appropriate to make some recommended actions for precautionary measures regarding contaminated soils. And this type of guidance or advice would apply to whether people were living in Midland, Kalamazoo or New Haven, Connecticut. We think that generally children -- parents who have

children with pica and parents of toddlers should encourage children to try to keep soil out of their mouths. That certainly is probably a lot easier said than done.

Other common sense measures include thoroughly washing your hands after exposure to the soil and washing or peeling any homegrown vegetables you may grow. We did collect some samples of homegrown vegetables in Michigan -- or Midland rather, and we don't have the final results yet, however, the preliminary data tend to indicate that the root crops such as beets and carrots do not absorb dioxin and simple peeling to remove the contaminated soil would probably remove any contamination.

That concludes our presentation. Right now I'd like to turn the program back over to Howard Zar. Thank you.

MR. ZAR: Thanks very much. We'll now take statements from government officials. I believe Mr. Lawrence Chadzynski from the Michigan Department of Public Health would like to make a statement. I can pass the microphone down to you at this point.

MR. CHADZYNSKI: Good evening, ladies and gentlemen. It's a pleasure for me to be here, to drive into the beautiful City of Midland. It was interesting

as we drove in we noted a sign as we were coming for dinner and it said fresh Tittabawassee fish, all you can eat. And we partook, it was delicious.

(Inaudible comments regarding EPA dinner invitation from MDNR were made.)

This is a three part presentation. I've asked that Dr. Benjamin Johnson, our staff epidemiologist and physician, talk about the medical aspects of the report. And Mr. John Hesse, marine biologist on our staff, who will discuss the fish advisory and his knowledge of fish.

In 1983 Howard Tanner, the then director of Michigan Department of Natural Resources, submitted two proposals to the United States Environmental Protection Agency requesting federal support to conduct dioxin studies in Michigan. Moreover, that these studies should be part of a larger national effort designed to answer the many questions related to dioxin contamination. Ten years have elapsed since the Michigan Department of Public Health first issued a formal fish consumption advisory for the Tittabawassee River.

In 1986 the center's fish advisory continued to recommend against the eating of Carp and Catfish, but reviewed the reduced levels of dioxin found in fish --

in the latest round of fish tested, removed the limitation of eating game fish. A week ago we issued a precautionary alert.

The EPA report before you today represents five years of concerted effort and study. The report augers well for Midland. The report shows that dioxin levels in soil, air emissions and discharge waters are fine, and that a downward trend is noted for fish sampling during the course of the study. We commend EPA for producing this excellent and comprehensive report. It was quite an effort.

I would now like to briefly comment on the risk assessment process presented in this report. Nationally, and even within EPA, there appears to be considerable debate of the risk assessment process in both sectors, public and private. Barry Commoner in a speech delivered to EPA in January of this year commented on what is now referred to as Factor 16; that is, that EPA was developing a new rationale for dioxin cancer risk assessment that shows the risk is 16 times lower than estimated by EPA in 1985. Lee Thomas, EPA's administrator, recently estimated that he would spend ten million dollars in fiscal year '89 on projects to reduce the uncertainties and risk assessment to improve our decision making responsibilities. We think that's

an excellent step.

The director of EPA's Office of Technology, Transfer and Regulatory Support quoted EPA plans to re-examine the assumptions that otherwise risk assessment. Part of this report states is the fact that the agencies all use different assumptions and arrive at different results. Examples of some of the changes the agency is considering is one, switching from the current assumption that people are exposed to a chemical 24 hours a day per day for several years to assuming an exposure of 16 hours a day for 10 to 35 years. Second, to consider only malignant tumors, not benign ones. And third, averaging the chemical's potency from experiments on a variety of animals instead of using a number derived on one single animal and the most sensitive one.

The report states that EPA's current approach is thought to overestimate human risk by a factor of ten. From our perspective in view of the literature and our own risk assessment process one observation can be made with some certainty, risk assessment provides us an important mathematical tool that substantially contributes to the decision making process, however, a risk assessment process is still in the early stages of development. There is much room for improvement but by

way of elimination of sources of uncertainty and of err and recognizing the great amount of professional judgment is still necessary. Dr. Vernon Houck, director of the Center of Environmental Health stated in the absence of other more certain data risk assessment is all there is. Just as it should not be denigrated as unhelpful because of its inevitable limitations neither should it be oversold as passe. We must apply the soundest professional and scientific judgment available in order to shape up the policy that's scientifically the best one.

In closing we would also like to commend Dow for its efforts and cooperation with the regulatory agencies in eliminating the dioxin problems in Midland. We must continue to work together at the local, state and federal levels. The making of the committment to restoring the quality of our environment, the making of our state for ourselves and for our product, I can assure you that Governor Blanchard and Raj Wiener, the Director of Public Health, share this commitment. Thank you.

MR. ZAR: Dr. Johnson is next.

DR. JOHNSON: I, too, will sit down, if you don't mind.

I'm Ben Johnson, I'm a physician and an

epidemiologist. I work with the State Health Department and Center for Environmental Sciences. I'd like to think being the only physician to speak brings us back to the health issues and just what we do know and what we suspect about the dangers of this chemical. And I'll challenge just for the moment with one thing. After millions of dollars of expenditure on investigations of this type there has yet to be a proven case of anything outside of chloracne in a human being.

Now, I'm not saying that there is no risk or that there cannot be, but we keep talking about cancer, we keep talking about liver disease, we talk about reproductive effects and we have yet to find any. And that we must continue looking because obviously in animal experiments and in laboratory experiments there have been good indications that this is a dangerous chemical, I don't doubt that. But I'd like to say as a physician I think first of the individual patients but I as an epidemiologist, as a scientist, we must look at broad populations. And that is what I think is sorely needed here.

We, as Mr. Chadzynski was saying, have a lot of risk estimation data based upon laboratory and animal experiments and then computer generated numbers that

may or may not mean anything. I have grave reservations about them. What we need and sorely lack is good human studies. These are not easy to come by because in the first place, as Dr. Nisbet said, it's very difficult to get dose response and a good estimate of how much dose is given, we can't experiment with human people with a dangerous chemical. But we do have a number of them that result from worker studies, from accidental exposures, and they're not as bad, I think, as we've been led to believe.

We tend to put off the record the experience and looking at the animals. For example, we have the very excellent study that was done here on the Dow Chemical workers. This covered many years and many thousands of people. The results of that were essentially negative in terms of cancer, birth defects or acne. The original study where there was noted severe exposure in workers was in Nitro, West Virginia. These people had severe exposure. All of them in the study group had chloracne. Chloracne indicates you've really got a dose of it. The experience following these people over the years has been up until now virtually negative, nothing.

Also there are the recent Seveso, Italy study where there was a large exposure accidentally, an

explosion, and many thousands of people were exposed. This was an opportunity to really look at the picture of whether there are reproductive effects. That study, which was recently released a month ago, showed us that in many, many thousands of births in the most exposed areas there were no unusual numbers of birth defects. That's very re-assuring. It's not absolute, not to say that it can't happen, but I think it's an important study.

As of two days ago the paper given on Times Beach, I think you're all familiar with that, this town in Virginia that was so heavily exposed -- or Virginia, Missouri that was so heavily exposed that they bought up the town and moved it away. But they studied those people very carefully, again, for reproductive effects and birth defects, nothing.

So these are important milestones and personally I believe human studies far more than the animals ones if I have a choice. Unfortunately, in a lot of cases we don't and we must go with the best information we have, either in the laboratory or in animals. So my feeling, especially with regard to reproductive effect, is that if there is a risk it is a very small one.

MS. HEBERT: Are you going to finish soon so we can talk?

DR. JOHNSON: Sure, in about two minutes. Let me just finish up.

UNIDENTIFIED CITIZEN: Take all the time you need.

MR. ZAR: The procedure is that we're going to take comments from government officials then we'll take questions and then statements. I don't think there are too many --

MS. HEBERT: What do you mean government officials? What do you mean?

MR. ZAR: Well, there's another gentleman from the Department of Public Health that's asked to speak and another gentleman from the city.

MS. HEBERT: So, what's --

MR. ZAR: Can you wait a few minutes --

MS. HEBERT: No.

MR. ZAR: We'll get to you, I'm sure.

MS. HEBERT: How does the hierarchy work here?

DR. JOHNSON: I'll be very brief. So what I wanted to say is with regard to pregnant women I certainly don't minimize the risk, and as a physician I know that we must do everything we can to protect them. But I do know that we live in a dangerous world. There are chemicals and there are exposures, there are toxins

and there are carcinogens in the very food we eat. And if we want to protect everyone to the greatest extent we'd have to put them in a glass case and feed them a formula, which we don't know how to prepare because we don't know what yet is dangerous.

So, we have to use a little common sense, I say that we do the best we can to protect our people. And, again, for that reason I agree, we should -- I go along with the recommendation that even though there's very little dioxin in all likelihood in fish now that for a woman to be absolutely sure I would not have a lot of fish any more than I would have any other kind of dietary imbalances, a good general diet in pregnancy is important. There are some known causes to pregnancy abnormalities, number one is smoking, number two is alcohol and somewhere way, way down the list is eating fish out of the Tittabawassee.

MR. ZAR: The last speaker is from the Department of Public Health is John Hesse.

MR. HESSE: Perhaps I can clarify some of the information you've been hearing this past week and some of which has been accurate and some hasn't about what our recommendations are on eating the fish. The EPA is entirely right that we're continuing our recommendation not to eat the Carp and Catfish from the river. No one

should be eating those species, they're much more heavily contaminated than the game fish.

With regard to game fish, we have a copy of our press release last year in the back of the room that talks about the recommendation as a precautionary measure at this point until the situation be better evaluated for women of child bearing age and pregnant women not to eat more than one meal of game fish from the river a month. That rate of consumption is essentially equivalent to the one picogram per kilogram body weight per day that Dr. Nisbet was talking about as long term safe level, or I guess that's reasonably close to what you call a reference dose.

We have been asked why aren't we saying or recognizing these extreme risks that EPA's report presents, and I think you heard tonight some of the uncertainty factors. Dr. Nisbet very well covered some of those and we take these factors into consideration along with some of the other things that Dr. Johnson mentioned as well in drawing our conclusions. Quantitative risk assessments are a tool and we use them to look at relative risks, one -- fish from one body of water to another, but we -- extrapolation to actual quantitative risks to humans have a great deal of uncertainty associated with it and sometimes this

uncertainty factor is recognized by EPA that there can be several orders of magnitude for true risk and we feel that is often the case.

Other factors that we considered in our recommendation is that we do have some very current local information in terms of fish consumption, rates for anglers on the Tittabawassee River. This data was generated under contract by our department by Dr. Brad Smith, one of your local researchers from Delta College. He's here tonight and perhaps can answer questions for some of you afterwards. We will have copies of that report available if you write to our department and ask for it, we have to get copies made yet.

But the consumption rate that we -- he found from interviewing 703 anglers last summer showed that the 90 percentile or 9 out of 10 people fishing the river were not eating fish more than one meal per month. Actually, 44 percent of the fishermen were throwing them back. That nine that ate that one meal per month rate is essentially equivalent to the occasional consumer that Dr. Nisbet showed on the slide. And that in terms of the game fish concentrations is close to the rate of that reference dose of one picogram per kilogram per day.

So, there's just a small percentage of the population, 10 percent, that may be eating more than that. And what our advisory is trying to target are those perhaps more sensitive proportions of the population of women of child bearing age and pregnant women in terms of protecting the possible effects of the fetus, but at this point that is not very certain of a risk.

The EPA report, of course, has pointed out possible decline in concentrations in the fish, and that this is probably going to be continuing as discharges continued to decline. We've seen these similar decreases in contaminants and in fish with situations like when we brought DDT under control in Michigan by banning it in 1969. PCB regulations went into effect, we've seen 90 percent decrease in PCB following the control of that. Mercury in the Lake St. Clair area dropped within two years, started to show dramatic decline as the fish here apparently are starting to show and it's continued to decline.

The cancer risk numbers are -- remember that they're generated using an assumption of 70 year exposure at the rate that they calculated as an average from 1983 to 1987, average concentration. And we can very fairly safely assume that those concentrations

aren't going to continue for 70 years.

And another mitigating factor is the fact that the risk assessments are done on uncooked, skin-on fillets. And if people follow the recommendations of taking the skin and the fat off, which we recommend, and it's in our Michigan Fishing Guide and there are copies of that back in the back room with our -- printed right in the documents that's given to anglers, by removing that fat and cooking it in ways to allow the fat to drip away further reductions as high as 90 percent of some of the other chemicals in the study that we funded in this past year on dioxin reduction in Carp from the Saginaw Bay. And this is brand new data, researchers at MSU showed 40 to 70 percent reduction just by cooking the fish by charbroiling. These are restructured Carp fillets that are prepared in a certain way. And also the fact that the human studies haven't shown evidence that people are as sensitive as animals to this chemical, perhaps they're much less sensitive.

The EPA policy change potentially coming up in the next few months that we suggest that maybe dioxin potencies aren't as great as they once thought is also another factor. So those are some of the things that we considered in our advisories. And I thought we should reiterate the position, apart from Catfish,

there are a few people as shown in Dr. Smith's survey that continue to eat this Carp and Catfish and there probably always will be those people who ignore the advisory, but we want to emphasize that they should be avoided and your spreading that word would be helpful to us.

Game fish are much lower than even most regulatory numbers or most other states or any other agency has set for a maximum level. Michigan uses ten parts per trillion in terms of trigger level. Those game fish are in the neighborhood of one part per trillion in those 1987 Walleye and using the toxic equivalent approach that brings them up to about four and a half parts per trillion. If we can confirm that's true it remains under our ten part per trillion trigger level. State of New York uses 10 parts per trillion, Canada uses 20 parts per trillion, FDA has stated a concern level of 25 parts per trillion. So we feel these are quite low levels and we'll continue to watch it and if the levels appear to change higher than we previously thought then, of course, we'll reconsider our position.

MR. ZAR: Thank you. I know we have one request to speak from Mr. McCaffrey, City of Midland.

MR. McCAFFREY: I will not sit down. I don't have any scientific data to give you. On behalf of the

citizens of the City of Midland, our Mayor regrets that he could not be here this evening, he's down at a sister city meeting, Midland, Alabama. And as the Mayor pro tem I would like on behalf of the citizens of this community to publicly thank the Environmental Protection Agency, the Michigan Department of Public Health and the Michigan Department of Natural Resources for the fine upstanding efforts they have given this community. They have given them the results of some, from what I have seen, some brilliant scientific minds at work, the cooperative effort between three agencies and also the cooperative effort of the local industries who have gone that extra mile, that extra step, which is always required in a community that is concerned and is aware. We thank you very much.

MR. ZAR: We thank you. Are there any other officials that would like to speak?

(No response.)

MR. ZAR: If not we'd like to accept questions of the panel and Department of Public Health, if they're willing, on anything that's been said so far. Just questions now, requests for clarification. We'll take comments later.

MS. HEBERT: Yes.

MR. ZAR: Is this a question, ma'am?

MS. HEBERT: Yes, a question. About the sample you took at the Rockwell dump when you were at your Minneapolis lab and it looked like tea, and you said to Larry Fink, if you tell anybody about this you're going to be in deep trouble. Tell me about that, huh? Tell me about that.

MR. ZAR: Is that me personally?

MS. HEBERT: You personally.

MR. ZAR: I never said such a thing.

MS. HEBERT: Yes, you did.

MR. ZAR: Are there any other questions?

MS. HEBERT: No, you don't ignore me, you talk about it.

MR. ZAR: I remember no such thing. I'll be happy to call Mr. Fink in the morning and ask him.

MS. HEBERT: Of course you do. And what about the unknown unidentified hydrocarbons in all of the water samples that we haven't yet identified, what about those?

MR. ZAR: I'll answer that second question. Mr. Amendola, do you want to try that one?

MS. HEBERT: Yeah, try that, Gary.

MR. AMENDOLA: Thank you, Howard. As part of the study of some of the drinking water wells we subjected the water samples to what are commonly

referred to as broad scan organic chemical analyses. And we, in our effort to try to be as complete as we could, we instructed the laboratories to identify all peaks that come out of these analyses to the extent that they can. And as part of the analytical work, the analysts, the consulting laboratories did an extensive analysis of these chromatograms and did identify several organic chemicals, many of which are common to oil and gas field type areas of which some of the Midland water samples are. Also, as part of that work there were some compounds that showed peaks that could not be identified. And we did not go back and redo analysis or try to figure that out because the initial effort was one that we believed was about as far as you could go without spending an exorbitant amount of money on each individual sample. We concluded from the analysis of the data we had that the levels of contaminants identified were certainly well below the -- either the drinking water criteria or standards or any maximum contaminant levels.

MS. HEBERT: 50 parts per trillion is kind of significant, Gary.

MR. AMENDOLA: Well, a peak that could show up in some of those analyses are not necessarily a toxic compound.

MS. HEBERT: You should have gone back and try to identify the peaks, right?

MR. AMENDOLA: We attempted to identify the peaks in the first analyses to the extent possible. There is a limit to how far you can go in that type of work and we think we did it.

MS. HEBERT: How's that? I don't understand what you're saying.

MR. ZAR: Am I correct that this questioner is Diane Hebert, representative of Greenpeace?

MS. HEBERT: I just live here, okay.

MR. ZAR: A resident of Midland, then?

MS. HEBERT: Yeah.

DR. OYEN: I'm Mrs. Oyen, a resident of Midland from the local health department.

MR. ZAR: Would you like to come up?

DR. OYEN: No, I was just going to ask Dr. Nisbet a question. You've been talking about one in ten thousand increased risk of cancer. Would you put it in perspective for people by mentioning what is the risk to any of us from just existing and perhaps what is the increased risk from smoking a pack of cigarettes a day.

DR. NISBET: The average person in this room has about 30 percent chance of developing cancer over

his or her lifetime and about 25 percent chance of dying of cancer. That's about 2,500 chances per 10,000. As far as cigarette smoking is concerned, a risk of one in ten thousand would result from smoking about one cigarette every six months.

MS. HEBERT: Could we talk about reproductive problems and liver damage.

MR. ZAR: Would you mind waiting until we finish with this one question, please.

MS. HEBERT: Sure, go ahead, finish, please.

MR. ZAR: Do you have more to say?

DR. NISBET: I think as far as answering that specific question that's sufficient.

DR. OYEN: Thank you.

MR. ZAR: Are there other questions?

UNIDENTIFIED CITIZEN: I have one. A comparison made on the up -- fish upstream from Dow with the fish downstream from Dow.

MR. AMENDOLA: Yeah. As you may know there is a -- or used to be a dam called the Dow dam right in the middle of the Dow plant and that dam served somewhat as a barrier to fish moving upstream, however, it did have a fish ladder associated with it all the time. There were data collected in, I think, 1978. In 1980 and 198 -- I think '78 and '80 were the two

principal times, and the fish collected downstream of Dow's effluent clearly were much higher in concentration than any of those found upstream. In some cases some levels of dioxin were found in some of the upstream fish, but not to the same extent. I trust that answers your question.

MR. MOORE: Dr. Oyen had an article in the paper here within the last ten days stating that radium has been found in the deep water wells of Midland and Saginaw and Bay Counties. Did you find any radium in the Dow brine which is down 5,000 feet and if so what hazard would that pose?

MR. ZAR: Can you answer that?

MR. AMENDOLA: No.

MR. ZAR: I don't think we looked for radioactive materials in this study and if Dr. Oyen would like to respond as she was there.

DR. OYEN: Well, I don't know anything about the analysis of Dow brine at 5,000 feet, these are 500 -- 400 foot wells with naturally occurring radium 226 and 228. It's a coincidental finding but we're following up on it.

MR. MOORE: The paper said 1,000 feet.

(Inaudible comments.)

MR. MOORE: Yes, it did.

MR. ZAR: Would the gentleman who asked the radium question please state his name. Would you state your name, sir?

MR. MOORE: Moore, Albert Moore, Ingersoll Township.

MR. ZAR: Thank you. Any other questions? This gentleman.

MR. PALUM: Yes, my name is John Palum, and I have a question about pica. Pica has been referred to here as an unusual occurrence, an uncommon medical condition. I could be wrong, but it's my understanding that it's really not all that uncommon. Can you verify that for me.

MR. ZAR: Dr. Nisbet.

DR. NISBET: I don't remember exactly in what words I characterized it in. It is not a rare phenomena, depending on how it's defined, it occurs in something like 1 to 3 percent of children.

MR. ZAR: Do you have an additional comment on that, Dr. McClanahan? Dr. Johnson?

DR. JOHNSON: I think I would state that it is a rare occurrence, classical pica. Now, every child goes through a phase of putting things in his mouth and that's not what we're talking about. This is really an excessive amount. And perhaps the 1 to 3 is reasonable

there but it only lasts between the ages of about one and a half and three.

MR. PALUM: So, do you call it pica when it's --

DR. JOHNSON: When it continues or gets beyond that, yes.

MR. PALUM: Beyond that between one and a half to three. (Inaudible comments.)

DR. JOHNSON: Well, that's normal behavior but I'm talking about really excessive. (Inaudible comments.)

MR. ZAR: Dr. Barnes has a comment on that.

DR. BARNES: Just to say that something which seemed as common as kids getting their hands dirty and putting them in their mouth, I was surprised to find about five years ago that there was really very little hard data on that. And much of what you have are people who are experts in this area who have started giving their professional judgment. Over the past three or four years, however, a series of studies have been conducted in this country and elsewhere trying to get a handle on that question, how much does the ordinary child eat, and those data are now coming in. Dr. Nisbet can comment on the risks.

DR. NISBET: Well, Dr. Barnes has said half

of what I was going to say. The estimates of the, quote, normal, unquote, intake by children that is used in the risk assessment are based on the recent studies that Dr. Barnes referred to and those are in the range of 100 to 500 milligrams swallowed per day. Depending on how pica is defined that may involve intakes in the amount of 10 grams or even more of soil per day.

MR. ZAR: Any further questions? The gentleman back there.

MR. PINE: My name's Harry Pine, I'm a resident of Midland. I just wanted to ask them about your recommendation that Dow monitor the sediment in the river. Do you have any idea what level you would regard as acceptable of dioxin in the river and do you have any ideas as to what type of things could be done about the sediment?

MR. AMENDOLA: Thank you, that's a very good question. In response to the first part of your question about what level would be acceptable, right now there are no sediment criteria per se as to classification of river or lake or harbor sediments for safe levels of dioxin. The concern we have about the sediments is that there may be levels of dioxin in pockets in the river where organic material may have accumulated or may have been exposed because of the

flood that might be introducing fairly significant quantities into the river. We don't think it is a very likely event, however, it's something that we believe should be looked at.

What we had in mind, and is pointed out in the draft risk management report, was some sort of a classification system to evaluate the sediments either visually or with some gross measure of organic analysis and then following up those that appear to be abnormal from the general river with a dioxin analysis. In the case of the Tittabawassee River our past sediment work has shown we have not been able to detect 2378-TCDD directly. We found at detection levels of 10 to 30 parts per trillion, however, we have found higher chlorinated dioxins and furans. The river, of course, as the fishermen here might know, has got a kind of a sandy gravely bottom, which is not very conducive, fortunately, toward collecting a lot of organic materials which might contain dioxin. I hope that responds to your question.

MR. ZAR: Further questions?

MR. MILLER: Yes. My name is Terry Miller, I'm a resident of Bay County, and I was asking questions around the sampling that was done on the water intake in the bay, Saginaw Bay. When were those

samples taken?

MR. AMENDOLA: I believe those samples were taken in 1984. I'd have to go back and check the exact dates.

MR. MILLER: Have they proved to be insignificant?

MR. AMENDOLA: No, none detected. We could not measure 2378-TCDD down to a level of I believe it was less than 5 or 10 parts per quadrillion, which is the state of the art for analytical work in drinking water supplies.

MR. MILLER: But as a follow-up question what I'd like explained, if possible, how do you account for the fact that in '85 there was a report based on the US Fish and Wildlife Service in the adult common Tern, of birds like the seagull, they found 25 parts per trillion of dioxin and in Tern eggs 3763 parts per trillion. And what this gentleman says is although humans do not eat Terns, what is happening with them is an environmental barometer for possible human health effects, T. J. Miller, contaminant specialist with the agency in the East Lansing office said on this date, January 10th, 1985, the study supports Canadian data that dioxin levels inherent in gull eggs from the Saginaw River, mouth and bay, 85 parts per trillion are

in the highest in the Great Lakes.

MR. AMENDOLA: We are aware of those data and it's not surprising to us that there is some contamination or accumulation of these pollutants in the food chain. In many cases the birds eat a lot of fish, which have low levels of contamination in them and dioxin is bio-accumulative. One of the unfortunate things about this chemical is that it doesn't degrade very readily in the environment and levels that -- or discharges that may have occurred several years ago may still be having their effect. I think Dr. Nisbet would like also to respond.

DR. NISBET: I can respond to that because I also study Terns. They are very -- as predecessors who are at the top of the aquatic food chain they are very efficient at concentrating chemicals such as dioxin and it's not unusual to have concentration factors of a hundred thousand or a million between water and the common Tern eggs. So there is no inconsistency between finding tens of parts per trillion in the Tern egg and not finding dioxin in the water at less than one part per quadrillion.

MR. MILLER: If I may ask another question. The risk advisory, there's been a lot of emphasis about the PCB content, of course, that's why we're here this

evening. But in the study you indicated that seven out of the nine chemicals found in fish aren't probable carcinogens but are known carcinogens. Were those carcinogens factored into the risk analysis when it came to the fish advisories?

MR. ZAR: I think -- Are you asking about the fish advisory?

MR. MILLER: Right, now on the Tittabawassee fish. I mean there were a number of chemicals that were found during your analysis of those fish. Now, the ones that you're looking at --

MR. ZAR: Are you asking -- You're asking whether it was figured into the Michigan fish advisory. And Michigan would have to answer a question like that. Is that the question?

MR. MILLER: I guess I was asking whether the EPA --

MR. ZAR: Can I put you on the spot, John?

MR. HESSE: Sure.

MR. ZAR: I already did, I guess.

MR. HESSE: We're aware of a lot of chemicals -- a lot of chemicals can be found in fish at low levels and not just in the Great Lakes or just the Tittabawassee River, but it's fairly common. I think IJC has identified something like a thousand chemicals

in the Great Lake system, sediment, water, fish, and a lot of them have shown up in fish. There's no real easy way to predict what the accumulative effect of all of them would be in combination. Some studies show that they're protective of one another or act antagonistically, some may look like they could be synergistic. PBB and PCB, for example, some studies have been done recently show that one -- the presence of the two of them protect against the effect of the other. So we at this point do take it into consideration, the levels of the other contaminants. The level in the Walleye PCBs in the Tittabawassee River appears to be just about the same level as what we're seeing in the Walleye in Lake Erie and Lake St. Clair and just about anywhere we collect, about four tenths of a part per million on an average. And it's -- And we use a sort of a protective way of taking that into consideration in that when 10 percent of the fish exceed any one of the FDA standards we do put a restrictive advisory on it. In this case the Walleye are not -- none of them are exceeding the standard for PCB, for instance. None of them are exceeding -- we don't have an official standard for dioxin but they're not exceeding the 10 parts per trillion trigger that we use. So it's just -- it's that state of the art that

we're using at this point. Those fish -- We're applying the same process to these fish as what we're trying to do in the other waters we study. It's nothing real unique in this river.

MRS. MANION: You're saying you consider --

MR. HESSE: Well, we don't consider, we've seen the data. I'm not sure about seven and nine. They're not added yet. We're aware of the presence of the chemicals, I don't know about the seven and nine being known carcinogens.

MRS. MANION: That's what it says on the report.

MR. HESSE: I haven't read that last bit of detail in that report.

MRS. MANION: It also says the PCBs (inaudible comments).

MR. ZAR: Excuse me, miss, could you speak up?

MRS. MANION: It says for PCB the upper bound of cancer risk by the consumption risk of Walleye from the Tittabawassee River similar to those posed by the PCB and the CDDS.

MR. HESSE: If we apply the FDA or the EPA risk assessment to fish in general, our EPA method, and

compare what the risk would be, even fish that meet the FDA standards, you're aware of the two parts per million FDA standards for PCBs, if we apply the same risk assessment approach that FDA is applying, fish meeting the FDA standard and, therefore, legal for human consumption -- or sale for human consumption carries a risk of approximately four in a thousand. That -- Each one of the FDA standards carry -- if the fish are right at the level carry about that risk using that type of methodology. None of the fish in the Great Lakes would meet the one in the hundred thousand level if you use that kind of methodology.

We have to consider some of these other mitigating factors when we take into consideration advisories. It's not just the Great Lakes that would have problems if we used -- applied that directive without considering some of these other factors that I mentioned earlier. Our Perch in Lake Michigan, for instance, have very, very low levels, ten parts per billion, of PCBs and yet they would carry a risk of greater than the one in a hundred thousand estimated risk of cancer. Yet, that's a very common figure in fish anywhere in the United States. I don't know if very many fish would have less than that.

MRS. MANION: Give me the bottom line,

though, are you doing one chemical at a time?

MR. HESSE: Yeah, one chemical at a time.

MRS. MANION: You didn't take into the account the other nine when you did the --

MR. HESSE: Only in the process of applying the 10 percent rule, and they would be added in that way. If they -- If one fish out of ten had PCBs, another fish had chlordane, then they would exceed the 10 percent rule and we would put a restriction on that fish on that basis. Whereas they would be perfectly fit for eating -- for sale in the commercial market. But the average on any of them wouldn't come anywhere near the FDA standards.

MRS. MANION: Are you saying you know or you don't know the risk of these others?

MR. HESSE: I don't think we know the risk on any of them, the actual true risk. It may be several orders of magnitude what the difference in the true risk in terms of what we projected. But it allows us to compare the fish from the Tittabawassee from fish elsewhere. And what I'm saying is that Tittabawassee River fish aren't that much different than other fish in other waters when we look at the comparable levels.

MR. MILLER: So other fish in the Great Lakes we expect to find similar values of these kinds of

chemicals?

MR. HESSE: Read them off for me.

MR. MILLER: PCTs, PCBs, chlordane, DDT, yeldren, exchlorabenzine, atropine, atrachlorastyrene, petrachloratoxide.

DR. NISBET: Yes.

MR. HESSE: Yes, you'll find those same chemicals in Lake Michigan fish.

MR. MILLER: And with pretty much the same values in terms of content?

MR. HESSE: I believe so. We did the analyses on those, I'm sure if that's the '85 data that you put in there, yes.

MR. ZAR: Can I move on to a different item. It sounds like you have some detailed interests there that are perhaps pursued directly at some other time.

If I could, I'd like to take one or two more questions, move onto statements and then if we have some time at the end take some more questions. That gentleman.

MR. MULLISON: My name is Wendal Mullison, I'm a resident of Midland. I want to ask Dr. Nisbet a question. In using the data for the toxic effects of 2378-TCDD in the fish, was it the whole fish, analysis of the whole fish or was it an analysis of the flesh

eating part of the fish that people would eat that you used in making your risk assessment?

DR. NISBET: The exposure assessment was based specifically on fillets and we combined data for fillets with skin on and fillets with skin off. Where they compared there was not a substantial difference. So we pooled all the data for fillets.

MR. MULLISON: Yes. My question, though, was the analysis of the content in the fish, was that based on analysis of the whole fish or was it based upon separate portions of the fish?

DR. NISBET: No, it was based on the edible tissue only, only on the fillets. There was some other analyses where the whole fish were analyzed and we didn't use those as part of the exposure assessment because those concentrations are likely to be higher because they are -- dioxin is concentrated in the viscera.

MR. ZAR: This gentleman.

MR. MARTIN: Yeah, my name is Doug Mark, I've got a question for Dr. Nisbet. I just wondered if you had ever studied the correlation between dioxin and maybe the possibility of smoking in lieu of lung cancer in respect to the dioxin that's been found in the quality of paper with using the chlorine process with

your dioxins in your paper, your cigarette paper, and also if you chew tobacco and get lung cancer, you don't have to light it up. I just wondered about the residue on the tobacco, have they ever looked at this as maybe being a major possibility of lung cancer?

DR. NISBET: I don't know of any studies which have investigated dioxin levels in either cigarettes or in tobacco smoke concentrate. It's only very recently that some have been found in papers, in cigarette papers, and that investigation hasn't gone on very far yet.

MR. ZAR: One last question.

MRS. MANION: I have two questions. When you do air sampling are there recovery rates for soil and water?

MR. AMENDOLA: There are two issues in air sampling dealing with -- dealing with that question. The first is capture efficiency, and that is a measure of whether or not the device you're using to collect the air sample is catching everything that's in that air sample. For both incinerator emission testing and ambient air testing for dioxins there is some uncertainty as to whether the capture devices, collection devices are catching 100 percent of all the material. There have been some recent studies, and

perhaps Dr. Barnes, do you have some comments on those.

DR. BARNES: Just on the question?

MR. AMENDOLA: Yes.

DR. BARNES: There was a study done for the Environmental Protection Agency to investigate the emissions of dioxins from combustion sources and some average results were obtained that raised that question about this, how good the capture efficiency was. And I must say I lost track of how that turned out. This was some time ago now, but people are going back to take a look to see what the answer to the question was. As I've just asked casually about it, I can give you some more detailed information when I get back to my office. There were questions raised about that study that the people had originally raised questions about it but now they think maybe it was not a problem. But to answer your question honestly, it's unsettled in my mind and I'd have to go back and check to see what the most recent information is.

MR. AMENDOLA: I would just like to point out that in the testing that was done here we did use what was thought to be the best state of the art for the air analysis for sampling technology. In the case of the ambient air samples we used a two phase system. The first was a fiber filter, which was commonly used to

collect particulate matter in air, and that was backed up by a polyurethane foam cartridge and all the air that went through the filter then went through this cartridge. And what we did find as part of that work was that some of the higher chlorinated dioxins, more of those were captured on the filter, and some of the tetra through pentadioxins, more of those were captured on the polyurethane foam. And that leads us to believe that we had a pretty good collection efficiency, although, you know, I can't state that it was 100 percent.

The second part of your -- of the issue of recovery that you raised is one dealing with analysis. And the analysis of an air sample, once the residue is collected it's subjected to essentially the same types of extraction and extract clean-up, analytical techniques as the soil or fish or any other type sample. There are recoveries associated with that.

In the air study we initially established some very stringent percent recoveries on the analytical systems and later we found that we didn't achieve all of those, but by and large the data obtained fell within acceptable ranges for recovery.

MRS. MANION: Does the recovery rate change the, you know, like the level of parts per billion for

recovery?

MR. AMENDOLA: Well, in the analyses the final result you get is adjusted for the recovery rate of a surrogate compound or spike level compound, so you take that into account in reporting the results.

MRS. MANION: So what was the -- I don't think you listed in the report like even a range of your -- (inaudible comments)

MR. AMENDOLA: In the risk assessment report I'm not -- we do have a companion report that has more detailed work on air, I'll be happy to get you a copy. And it'll have all those recovery rates specified for each sample that was collected and analyzed.

UNIDENTIFIED CITIZEN: The second part of my question is why do you use double negatives when you express the conclusions of your work?

MR. AMENDOLA: You're talking about "does not pose unacceptable risks." I think that's kind of a term of art in risk communication that has evolved, and I don't know the origin of it, perhaps some of the other fellows on the panel do. Dr. McClanahan, do you want to touch that one?

DR. McCLANAHAN: I'm not in charge of public records.

MR. ZAR: Are there any burning questions?

I'll take one burning question only and then we have to give people a chance to make statements. This lady has a burning question.

BARBARA: My name is Barbara and I'm from the Department of Natural Resources in Ann Arbor. I have a question for EPA about how you handle the other chemicals, the PCBs and other chemicals that were in the fish, how do those impact on the risk assessment, both carcinogenic and non-carcinogenic?

DR. NISBET: Yes, that's addressed specifically in Appendix B to the report. The -- Both the carcinogenic risks and potential non-carcinogenic risks posed by these nine chemicals are considered briefly in that appendix.

BARBARA: Yes, but you did not say how they impacted on your risks of dioxin.

DR. NISBET: The -- Briefly eight of the nine compounds or groups of compounds posed completely negligible risks relative to the dioxin. The PCBs would pose risk both cancer and non-cancer effects, which would be in the same ballpark as the dioxins. So the two together would be on the order of twice the risks calculated for the dioxins alone if the effects were additive. Now, we discussed whether they might be more additive or more than additive or less than

additive and the evidence one way or the other is very scanty, so we didn't draw any conclusions in that regard.

MS. HEBERT: She's not just talking about PCBs and dioxins, she's talking about other chemicals. You haven't addressed that.

DR. NISBET: I specifically addressed all the chemicals which have been detected in the fish.

MS. HEBERT: So list them, please. Would you please list them.

MR. ZAR: There are nine chemicals listed in the appendix which --

DR. NISBET: Appendix B.

MR. ZAR: Appendix B.

MS. HEBERT: So what are they?

MR. ZAR: And they were read into the record earlier.

MS. HEBERT: Why don't you just list them now, Howard?

MR. ZAR: I said I wouldn't.

MS. HEBERT: You wouldn't what?

DR. NISBET: Would you like to take public comments now?

MR. ZAR: Yeah, I'd like to take public comments. You asked quite a few questions, miss.

MRS. MANION: It's just one quick one. On your map on page 60 you have dots and circles, would you just explain what those each signify as to the sampling?

MR. ZAR: Double negatives, now dots and circles and then we'll take comments.

MR. AMENDOLA: On page 60 this is a graph or a chart that I had nothing to do with. I believe the dots, the ones that are filled in, are samples that were collected and analyzed and the circles were samples that were collected but not analyzed. As you recall at the time we did this oil study we took more samples than we analyzed in case we had to go back to reinforce or assure ourselves of what our conclusions were.

MS. HEBERT: Can you take --

MR. AMENDOLA: Excuse me, I'd like to finish this answer, please.

MS. HEBERT: Go ahead.

MR. AMENDOLA: So we didn't take -- we didn't analyze every sample collected. And the circles represent those that had not been analyzed.

MR. ZAR: That will be the end of the question period. If we have some time at the end we can take some more questions. Are there any

individuals who wish to make statements? This gentleman.

MR. MILLER: Yes, Terry Miller from Bay County. I hadn't originally intended to make this statement but a member of the Michigan Department of Health brought up Barry Commoner and apparently he had addressed the EPA earlier in the year and I think just a few of his comments might be appropriate this evening and then I would like to finish with a comment of my own.

Our environmental legislation, and this comes from a presentation by Dr. Barry Commoner, our environmental legislation ignores the origin of the assaults on environmental quality, fails to recognize that environmental pollution is an essentially incurable disease that can only be prevented and instead deals with its symptoms.

The present largely unsuccessful regulatory effort is based upon the now well established procedure. First the EPA estimates the degree of harm caused by different levels of various environmental pollutants. Next some acceptable level of harm is chosen, for example, a cancer risk of one in a million. And the EPA establishes emission standards that can presumably achieve that risk level.

Polluters are then expected to introduce controls such as auto exhaust catalysts or power plant stack scrubbers, read sand pits or sand traps that will lower emissions to the required level. If the regulation survives the inevitable challenges from industry and in recent years from the administration itself the polluters will invest in the appropriate control systems. If all goes well, and it frequently does not, at least some areas of the country and some production facilities will then be in compliance.

Clearly this process is the inverse of our preventive approach to public health. It strives not for a continuous improvement in environmental quality but for the social acceptance of some presumably low risks to health in a way that represents a return to the medieval approach to disease in which illness and death itself was regarded as a devil on life endured as payment for original sin. In our updated version we think that some level of pollution and some risk to health is the inevitable price to be paid for the material benefits of modern technology. Some of us are not willing to accept that.

And many of us feel, and this is from my position, this isn't Dr. Commoner, many of us here, many of us will feel far more comfortable when the Dow Chemical

Company eliminates product lines that produces and introduces dioxin into the environment regardless of how small the quality. Thank you.

MR. ZAR: Any further comments on the risk management or risk assessment reports?

MR. HEBERT: Yes, Howard, I'll see you in court about that sample at Rockwell. Yes.

MR. ZAR: It's a statement, I guess. Next comment. Gentleman in the green jacket.

MR. KUTCHIN: Yes, I've been sitting here listening --

MR. ZAR: Your name, sir.

MR. KUTCHIN: The name is Sam Kutchin of Midland here, but as Mayor pro tem McCaffrey thanked you all for being here I think we've got to take into consideration that a lot of these people here aren't sitting home and watching the boob tube, they're out here, you know, trying to get informed about things and I think it would be nice, since their names are up there, if we could get a summary of the report of tonight's meeting.

MR. ZAR: You're asking for a summary of the meeting, of this meeting?

MR. KUTCHIN: Yup.

MR. ZAR: I think we can do that. We intend

to, I guess I didn't say this, but we intend to put into the repository a summary of the comments received, not only of those made tonight but also those received in writing, as soon as we get it done and also certainly the risk -- the final risk management document when we get it done. The locations of the repositories are listed on the fact sheet, the gray document that we held up a few times.

MR. KUTCHIN: Thank you.

MR. ZAR: Any other statements? The gentleman in the back.

MR. FAREEVY: Yeah, I was just wondering, I heard chlorine mentioned a couple times along with dioxin. In an offbeat way is there any relation between dioxin and chlorine?

MR. ZAR: Fluorine?

UNIDENTIFIED CITIZEN: Chlorine.

MR. ZAR: Chlorine?

MR. FAREEVY: Chlorine, yeah.

DR. BARNES: Dioxin, the way it's been defined here tonight, is a -- it is a compound which contains chlorine. Table salt contains chlorine, a lot of things contain chlorine. But particular -- So, there's nothing inherently bad about chlorine itself, but in a particular combination with other atoms it can

form compounds which are problems, and 2378-TCD, which we're saying is dioxin, is such a problem -- is such a compound that can produce a problem.

I'm sorry, we didn't get your name for the record.

MR. FAREEVY: Jack Fareevy.

MR. ZAR: The gentleman in the brown jacket. Your name, sir?

MR. MOORE: I'm Pat Moore from Ingersoll, and I've been in on this pollution bit since about 1970 when the Ingersoll Township Zoning Board first banned the deep well injection of Dow chemicals in the Township of Ingersoll. Ingersoll Township Board has been in on this right from the start. And when those words, dioxin, came out they saw it then as information that they had not been able to get before. So right from the beginning Ingersoll has been in favor of the EPA coming in here.

I attended the first meeting down in the union hall that Don Albosta called, Dave Stringham of the EPA Chicago carried the load. Gary Amendola was not even in on it at that time. Later on Amendola came into the picture. I was really surprised tonight to hear the words of Harry McCaffrey. I remember some of the words that he and Mann and Bill Welch spoke when they were coming in here. They were very, very unhappy. We were

going to be Times Beach, we were going to be Love Canal, we were going to have our image ruined. The money changers on Main Street were no longer going to hear any clinking in their cash registers. Was a horrible thing to have these guys come in. They come in, they did their job, and they're giving their honest opinion, and I think it's a wonderful thing that they did come in.

Now, if we have to look back to see where we were say ten years ago to see how far we've come, let's take a look at a few of the things as they were ten years ago. Let's go to Bay County, there's been a benzene spill near Auburn that was allowed to soak away, nothing done. DNR didn't do anything. After we got these people activated and the DNR moving it was cleaned up. It was found that instead of dissipating and biodegrading as Dow had told them it would it was scattered over a wide area, and I understand it cost about a million dollars out there to try to clean that up.

Along in the '50s put a lot of benzene tars along Rockwell Drive in Bay County. It wasn't until the late '70s that a lot of the people out there was wondering what it was all about. One hunter went in there with his dog, he sat down, he went home and he lost all the

hair off his butt. Another dog made the mistake of lapping it up, his life was short, he was gone the next day. Stan Wasic, who was supervisor of Midland or Williams Township heard about some of this stuff, he went over there and was wandering around there to see what it was all about. Dow security caught him in there and they were going it put old Stan in the hoosegow. He had to do a lot of fast talking to tell them who he was and so on to get out of there.

At the last meeting we had at Williams Township Hall in which the Dow officials attended they invited all of us, including Stan Wasic, to go out and look at this new Rockwell -- new Rockwell, the songbird landfill which is supposed to be the Cadillac of all landfills. The Rockwell landfill is now kept, it is now monitored and there's no more of that seeping down the drain. The Poseyville landfill was never supposed to have any toxic substances in it. Any of you drive out Poseyville Road know that that is now monitored, it is now drained and it is kept. The deep well injection of toxic substances has ceased.

Under the City of Midland all Dow property being injected to both toxic substances they have, the Dow Chemical under ground, under pressure. When the Fortune magazine editor was in here he asked one of the

people from Dow Chemical where that stuff was going after it was injected in there, they said they didn't know. I want to add that they didn't give a damn. They also injected the brine lace out in our countryside and as the result of that we got a very unusual smell in our water supply. Sandy Mannion can tell you about that, it smells like rotten eggs, H2S. We asked Dow whether or not they were putting any sulfur compound down there, they said no we're not putting that. But what if you crack the rock structure when you put this pressure off, and if you injected it at a thousand pounds per square inch of the surface by the time it gets down 5,000 feet you got enough pressure to crack rocks as Dutch Boyle found out when he ran the experiment way back in the '30s. Somebody ask Dutch where that stuff was going that he was cracking the rocks was going, he said, oh, I think that may end up in Saginaw Bay. He was apparently working in the Saginaw structure.

Now, that this is ceased my wife silver's no longer blackens, you can go into the bathroom or the kitchen without smelling rotten eggs. I don't know about Mannion, yours gone, too?

MS. MANNION: Pretty much.

MR. MOORE: Yup. So, Dow didn't do it, it

wasn't Dow's stuff. But if you crack the rock structure down there, release some of this stuff there's only one place for the gas to come. And when it hits your ground water supply you're going to have it.

Now, we got other side effects from this. The fact that EPA come in here and did what they did and got the DNR started under Dr. Tanner, we could never get Dr. Tanner up here, he never did anything. But after the EPA came in maybe they had good graces or maybe the other guys decided to enforce the law, the oil field wastes are being taken care of. If any of you have driven down through Porter, gone down to the oil fields, you'll see areas there barren but salt crystals on the ground from the oil field waste. If you go through Williams Township you won't see that and if there is a leak in one of those pits out there the DNR is out there the next day.

The roadside dumping is practically seen. The roadside dumping is practically seen. Not only that but we're getting fast action. About a month ago there was a diesel spill that got down the river, went through the Dow property on the well. The fisherman reported it. It wouldn't have happened ten years ago, number one there wouldn't have been any fishermen in

there, if he had been he wouldn't have reported it because he figured it come from the Dow property and in Midland you do not report things about Dow if you want to live in peace with your neighbors, I can tell you that. The DNR was in there the next day. Not only that but the TV stations were in, they were taking a picture of the man, trying to put his hands over the camera. He was hauled into court and fined. Not only that but they caught him for having stored salt on his property without proper coverage. And in the paper tonight it said he got fined $800 for that.

Now, this is a far cry from what we used to get when we called Dr. Tanner. So I think the whole thing has been very beneficial from everybody's standpoint and I think from the standpoint of Dow it has been also very beneficial. They spent something like 60 million dollars enhancing their image. They didn't like the Dow title with dioxin in it. They didn't like the cartoonist. They didn't like the article of Wall Street Journal, they didn't like it in Fortune, they didn't like it in Business Week, it was destroying their image. Popov, who's now head of the Dow Chemical, made a speech recently in Sarnia and he said that perception is reality. No matter what you tell these people what they see is what they're going to

believe. And that is what happened in this case.

I thank you.

MR. ZAR: Thank you. I might mention that back in 1983 when Howard Tanner wrote the letter that got all this stuff started, and there were some other things that got them started, too, but that certainly was one of the items. This gentleman.

MR. RIO: My name's Mike Rio and I am the manager in engineering and environmental and computers for the Midland region of Dow Chemical and I would like to thank EPA for this very comprehensive and exhaustive study. I'd also like to thank Mr. Moore and Mrs. Mannion and the folks who have firmly urged us through the years to change the way we do our business, and they certainly have had an impact on us and I think it's been a positive impact because I think we would all admit that today Midland is a very much cleaner and better community than it has been in the past.

I'd also like to say that I think the study that you completed and we've cooperated with you in both the stages have been a very positive experience for me and for the Dow Chemical Company. It's probably as comprehensive and as substantive and exhaustive a study that has ever been done on any community that I'm aware of. And I think this will probably serve as a model

for other studies that EPA would want to do in the future.

I'd also like to pledge to you and to the community that we will continue the efforts. The improvements that you've showed on the screen are not something that's a thing of the past, we're going to continue our efforts to make these numbers even lower and make Midland an even better community to live in. So thank you very much and thank the community for its indulgence over the last several years.

MR. ZAR: This might be a good time to introduce some other EPA people who have been involved in this. There may be some state people here, too, but -- and I don't know their names so I apologize for that. But Jon Barney who has done a lot of the editorial work and has been the project manager for the risk assessment, he's worked harder than most of us have up here on the risk assessment I'd say over the last five years. Carol Witt is working on the RCRA permit, John Perrecone back there somewhere is our public affairs officer. Lisa Dubois is a contractor, Louise Fabinski is somewhere out there is from ASTDR.

Are there any more statements or comments, please?

(No response.)

MR. ZAR: Are there any more questions for

the panels or panel or for the speakers? This lady. Your name, please?

MS. JAMES: Sandy James. Do you have a trigger point for, you know, the soil sampling where you would take action, for instance, like you did in the (inaudible), I think it was one part per billion in soil samples. Does that still hold or I would like to know (inaudible comments)?

MR. ZAR: Dr. McClanahan, you want to try that one?

UNIDENTIFIED PERSON: What's the question?

DR. McCLANAHAN: Her question dealt with is there a trigger point for the concentration of dioxin in soil. As the document that was developed for Times Beach specified that that was a site specific evaluation, same sort of thing would have to be dealt with for any other particular location. And into the conditions of that particular city, (inaudible) might be developed. So I mean you couldn't just say if you find one it's automatically going to be an action level. It would have to be developed based on specific situations of that community or that particular group of samples.

MS. JAMES: So you have a different trigger point for each area that you investigate?

DR. McCLANAHAN: Yeah, that's the way it was intended and that's the way basically it's supposed to be.

MS. JAMES: In Midland what would the guess be?

DR. McCLANAHAN: Guesses don't work.

MS. JAMES: Well, how do you decide?

DR. McCLANAHAN: Basically you go through the same sort of risk evaluation for Midland for the group of samples that were collected in Midland with the people who are living in the community where the samples were found, what the distribution of the contaminant is and taking into consideration state of the art in terms of the potency factor of the dioxins at the time the calculation was made, the soil ingestion rate and things that -- things have changed over the years since that first calculation was made. That was five years ago, six years ago, things change. So, again site specific factors. It might be one but you can't just guess at what the number is going to be. If it's something that's going to be applied in this specific community or whatever community you're dealing with.

MR. ZAR: Gentleman on the right here.

UNIDENTIFIED CITIZEN: What range was that?

Is there a range? I know you can't indicate a particular number but would there be enough for a lower limit?

MR. ZAR: I'm sure there's some upper limit. I mean we wouldn't want to leave 100 parts per billion around someplace, but it'd just have to be dealt with on a, you know, the particular instance that we were seeing in that particular location at the time that that occurred. So probably would be -- might not be a whole lot different than one, it might be five. I've seen many (inaudible) reviewing the estimates.

Exposure of average values for a -- for an area not just on one sample that happens to be in excess of the particular number. We basically deal with what's more or less average concentration. It's also -- there's a risk as to upper bound, upper bound number.

MR. ZAR: One or two more questions if there are any. Anyone? An unlimited supply. Your name.

MS. MANION: Sandy Mannion. When did you do dusting from inside homes? It's recommended for the future, why didn't you do them?

MR. AMENDOLA: Again a very good question. When we started out with the odds of the study we tried to estimate what we considered to be at that time the major or principal exposure routes, which would be

consumption of fish, air, possibly drinking water, and soils, of course. We thought about doing dust samples but we deferred to see what we got on the first phase of the work. Unfortunately, you know this process has taken much longer than I think anybody would have liked and it was one of those things that if we rolled back the clock we probably would have went around and collected some vacuum cleaner dust or something like that to get some estimate of indoor exposure.

MR. ZAR: Any more questions? We have one more.

UNIDENTIFIED CITIZEN: I'd just like to thank you for your efforts and even though it did take five years it sounds like they were very worthwhile and very positive results and I have a sense that you probably don't get the same kind of partnership in other communities throughout this state and perhaps even in the other states. Good luck in the future. Thank you very much.

MR. ZAR: Mr. Amendola has the longest period, he's going to respond to that.

MR. AMENDOLA: I started working on this project before it became a project, actually back in 1978. And I must say that over the last five or six years the cooperation we've got from the city, the

people in the community and Dow Chemical have been marvelous. We have not -- We certainly had some heated discussions and arguments at times but when push came to shove the cooperation was there and I think people were generally interested in finding out what the bottom line was as opposed to trying to obscure the process. And I'd like to just thank everybody for that.

MR. ZAR: Gentleman in the jacket.

UNIDENTIFIED CITIZEN: One quick question for Mr. Amendola. I was just wondering who peer reviewed the whole report? I recall a report approximately ten years ago that the EPA read a multinational peer review report and we've seen a lot of flack over and I wondered who peer reviewed --

MR. ZAR: There's a -- I'll give a partial answer, Gary can answer it. In the risk assessment up front you'll find an acknowledgment section listing a large number of people who participated in the development and who reviewed it including several people from other federal agencies.

MR. AMENDOLA: There's no more to add. Mrs. Manion.

MS. MANION: I'd like to know, I think you've recommended that Dow do some Walleye sampling for the

spring of '88, during the spring run. Why did you recommend the spring run when the fish have been out in the bay through the winter? Am I correct, is that -- they come in the river in the spring, so why wouldn't you sample --

MR. AMENDOLA: I think maybe John Hesse could talk about the habits of the fish somewhat, but our understanding is that those fish are exposed to the mouth of the river and in the river for some time before they actually run up the river. The spring run is one type of set of samples that will be collected. We'll also analyze in the summer some more resident fish, the Carp and the Catfish and possibly some game fish. But as far as a continuing program to better characterize the fishery, it's not done as an attempt to find fish that might be low, for instance.

MS. MANION: I just wondered why you did it in the spring.

MR. AMENDOLA: The spring run fish are fish that people are catching and eating a lot of so it's important to characterize those fish. And data we got in '85, for example, where there was spring run, summer Walleye and so forth showed very little, if any, statistically significant differences in those fish from different types of year.

MR. ZAR: Some more questions?

(No response.)

MR. ZAR: If not we'd like to thank you for coming. We've enjoyed our five years in Midland, we're looking forward to a shorter period of time to close this out and hopefully things are cleaning up fairly well so we won't have to be here to the same extent in the next five years. Thanks again.

(Proceedings concluded.)

STATE OF MICHIGAN)
) SS.
COUNTY OF SAGINAW)

I, Kathy Brown, Shorthand Reporter, do hereby certify that I recorded in shorthand the proceedings had and testimony taken in the aforementioned proceedings on the 28th day of April, 1988 in the City of Midland.

I further certify that the foregoing and attached 98 typewritten pages or parts of pages constitute a full, true, and correct transcript of my shorthand notes then and there taken.

Kathy M. Brown

Kathy Brown
Shorthand Reporter

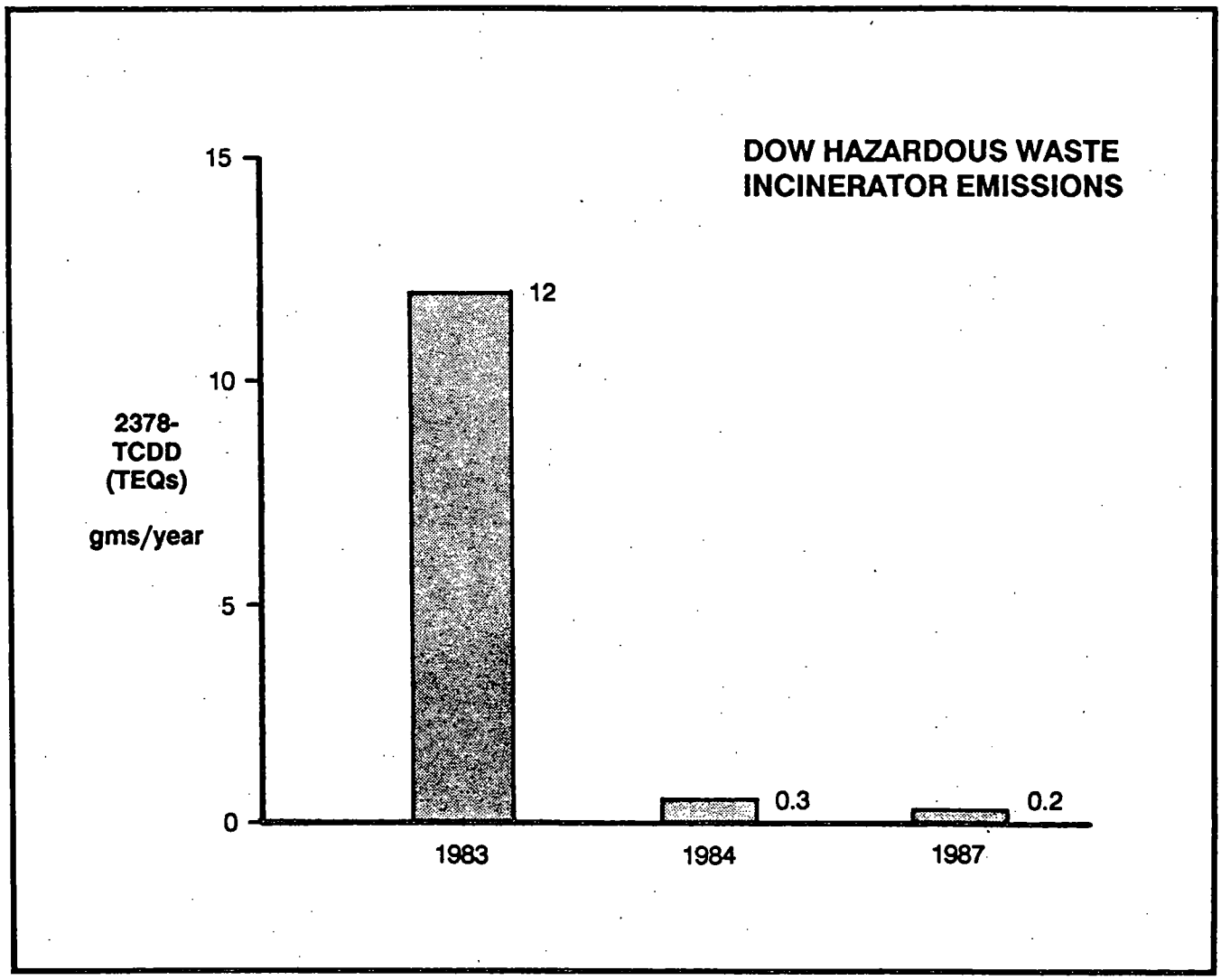
APPENDIX A

SITE HISTORY

1978	-	Dow notifies MDNR of dioxin in fish
1978	-	MDPH issues Tittabawassee River fish advisory
1978 to 1981	-	MDNR/U.S. EPA studies
1983	-	State requests U.S. EPA assistance

MICHIGAN DIOXIN STUDIES

1985	-	City of Midland and Dow Soil Studies
1985	-	Drinking Water Studies
1986	-	Dow Wastewater and Tittabawassee River Studies
1987	-	Dow Incinerator and Ambient Air Studies
1988	-	Risk Assessment and Proposed Risk Management


DOW HAZARDOUS WASTE
INCINERATOR EMISSIONS
2378-
TCDD
(TEQs)
gms/year
15
10
5
0
12
0.3
0.2
1983
1984
1987

FISH CONTAMINATION CONCLUSIONS

- Average levels in 1983 and 1985 fish are about the same
- Average levels in 1987 fish appear to be decreasing, but sample size is limited
- More studies are needed in 1988 and 1989 to confirm 1987 results

INCINERATOR EMISSIONS AND AIR STUDY CONCLUSIONS

- Incinerator emissions have decreased since 1983
- Dioxin was found in air outside Dow plant in 1983 and 1984
- Sources of dioxin contamination in Midland include current and past incinerator emissions, past process emissions, and windblown site dust

DRINKING WATER STUDIES

- 2378-TCDD not found in water supply intakes from Saginaw Bay
- 2378-TCDD not found in 16 drinking water wells tested outside Midland
- No other toxic organic chemicals were found in significant levels

SOIL STUDY CONCLUSIONS

- Highest 2378-TCDD levels found inside Dow plant; up to 36 ppb
- Contamination in Midland averaged < 0.1 ppb 2378-TCDD
- Dow air emissions are likely source of contamination in city soils

RECOMMENDED PRECAUTIONARY MEASURES
TITTABAWASSEE RIVER FISH

- **Everyone should avoid eating Tittabawassee catfish and carp**
- **Women of child-bearing age and children should avoid eating any fish caught in the Tittabawassee River**
- **Others should limit eating Tittabawassee game fish to no more than one meal per month**
- **Any fish consumed should be cleaned according to MDPH recommendations**

PROPOSED RISK MANAGMENT ACTIONS FOR DOW CHEMICAL

<u>Wastewater</u>

- Research on Additional Treatment
- Incinerator and Pond Sediment Studies

<u>Air</u>

- Improve Incinerator Controls
- Dust Suppression Program

RECOMMENDED PRECAUTIONARY MEASURES
MIDLAND AREA SOILS

- Parents of toddlers and children with pica should encourage children to keep soil out of their mouths
- Thoroughly wash hands after exposure to outdoor soil
- Wash or peel home-grown vegetables before eating
- Clean house to remove indoor dust

PROPOSED MONITORING PROGRAMS FOR DOW CHEMICAL

- Continued Wastewater Discharge Monitoring
- Supplemental Incinerator Emissions and Ambient Air Testing
- Continued Tittabawassee River Fish Monitoring
- Tittabawassee River Sediment Monitoring
- Limited Food Chain Studies

EXPOSURE SCENARIOS

	Higher	Lower
AIR	Fenceline	Residential Area
SOIL	More Exposure Child with Pica	Less Exposure
FISH	Maximum Consumer High Sports Fisherman	Occasional Consumer Median Sports Fisherman

SUMMARY OF ESTIMATED UPPER BOUND CANCER RISKS FROM EXPOSURE TO DIOXIN CONTAMINATION IN MIDLAND, MICHIGAN

Exposure Route	Estimated Upper Bound Cancer Risk	
	Higher Estimate	Lower Estimate
Fish	1 in 100 (maximum consumer) 1 in 1,000 (maximum fisherman)	1 in 1,000 (median fisherman) 1 in 10,000 (occasional consumer)
Soil	1 in 100,000 (upper estimate) 1 in 10,000 (child with pica)	1 in 1,000,000 (lower estimate) ---
Air	1 in 10,000 (fenceline)	1 in 100,000 (residential area)

SUMMARY OF HAZARD INDICES FOR NONCANCER HEALTH EFFECTS

Exposure Route	Exposure Scenario	Hazard Index		
		Long-Term	Short-Term	Single Meal
FISH	Maximum Consumer	50	5	8
	Sports Fisherman - Avg.	9	0.7	0.2
	Occasional Consumer	0.7	0.4	0.2
SOIL	Upper Estimate Young Child			
	- with Pica	6	0.2	---
	- without Pica	0.6	<0.1	---
	Lower Estimate Young Child	<0.1	<0.1	---
	Upper Estimate Adult	<0.1	<0.1	---
AIR	Infant at Fenceline	3	0.1	---
	Child at Fenceline	1	<0.1	---
	Child at Residential Area	0.3	<0.1	---
	Adult in Residential Area	<0.1	<0.1	---

TOXICOLOGIC PARAMETERS FOR 2378-TCDD

Toxicologic End Point	Parameter Type	Parameter Value
Cancer	Dose-Response Slope (95% upper confidence limit)	1.6×10^{-4} $(pg/kg/day)^{-1}$
Teratogenesis/ Reproductive Effects:		
long-term exposures	RfD	1 pg/kg/day
single-dose exposures	HA	300 pg/kg/day
Hepatotoxicity (liver effects):		
long-term exposures	RfD	1 pg/kg/day
short (10-day) exposures	HA	28 pg/kg/day
single-dose exposures	HA	280 pg/kg/day

SUMMARY OF ESTIMATED UPPER BOUND CANCER RISKS FROM EXPOSURE TO DIOXIN CONTAMINATION IN MIDLAND, MICHIGAN

Exposure Route	Estimated Upper Bound Cancer Risk	
	Higher Estimate	Lower Estimate
Fish	10^{-2} (maximum consumer) 10^{-3} (high sports fisherman)	10^{-3} (median sports fisherman) 10^{-4} (general consumer)
Soil	10^{-5} (upper estimate) 10^{-4} (child with pica)	10^{-6} (lower estimate) ---
Air	10^{-4} (fenceline)	10^{-5} (residential area)